THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LVI. No. 1417.] LONDON, JULY 8, 1890. [42ND YEAR. Price 6d.

WOLSTON'S Paste and Ready Mixed for Use.
Guaranteed Free from Adulteration. **TORBAY PAINTS.**
FOR GASHOLDERS, &c., &c.
The Original "Torbay Paints"
As supplied during many years to the LONDON GASLIGHT & COKE COMPANY.
Illustrated Price List Post Free.
TORBAY & DART PAINT Co., Ld.,
23, Gt. George St., Westminster, S.W.
DARTMOUTH, & BRIXHAM (TORBAY).

— ESTABLISHED 1830. —
PARKER & LESTER,
Manufacturers & Contractors.
THE ONLY MAKERS OF
PATENT ANTIMONY PAINT,
Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores for Gas and Water Works.
WORKS:
ORMSIDE STREET, OLD KENT ROAD, LONDON.
Ashmore, Benson, Pease, & Co., Ld.,
STOCKTON-ON-TEES,
Manufacturing Gas Engineers.
See Advertisement, p. 8.

CEMENT
EARLE'S
BEST
Portland Cement
MANUFACTURED BY
GEO. & THOS. EARLE,
HULL.
Office: 7, PIER STREET.
Works: WILMINGTON.
STOREAGE CAPACITY 10,000 Tons.
ESTABLISHED 1811—OVER THREE QUARTERS OF A CENTURY.
Telegraphic Address: "CEMENT HULL."

NORTON'S PATENT
"ABYSSINIAN" & ARTESIAN TUBE WELLS,
FOR TOWN WATER-WORKS AND OTHER SUPPLIES.
The following Town Water-Works Supplies have been obtained by this System, viz. :—Abbott's Langley, Aldershot, Alnwick, Cirencester, Hertford, Lechlade, St. Albans, Shrewsbury, Skegness, Southampton, Stony Stratford, Swansea, Wallingford, Watford, West Worthing, Wimborne, &c.
LE GRAND & SUTCLIFF,
HYDRAULIC ENGINEERS, 100, BUNHILL ROW, LONDON, E.C.

FUEL ECONOMY.
MELDRUM'S PATENT FURNACES
RAISE STEAM BY BURNING
BREEZE, COAL DUST,
AND OTHER SMALL AND POOR FUEL.
Telegrams: "Meldrum Manchester."
REALIZED SAVING UP TO
Results Guaranteed.
£200
PER BOILER PER ANNUM.
MELDRUM BROTHERS,
26, HALF STREET, CATHEDRAL YARD, MANCHESTER.

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER & BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM

(ESTABLISHED 1765),

MANUFACTURER OF TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST IRON TANKS FOR DITTO,

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, and all kinds of GAS APPARATUS,

Wrought-Iron Roofs, Bridges, Girders, &c.,

Steam, Hot Water, and Range Boilers, Tanks, Cisterns, Boats, and all kinds of Wrought-Iron Work.

DRAWINGS, SPECIFICATIONS, AND ESTIMATES SUPPLIED ON APPLICATION.

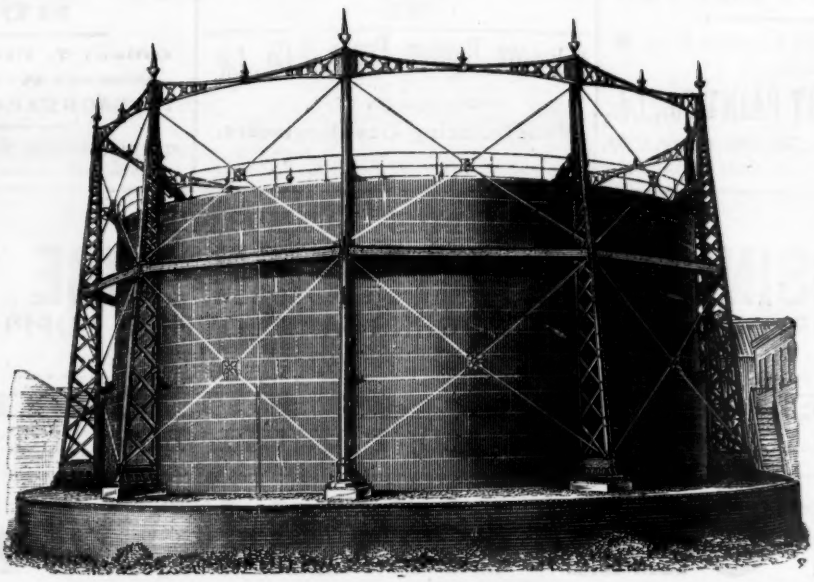
TELEGRAPHIC ADDRESS: "COCKEY'S FROME."

EDWARD COCKEY & SONS, Ld.,

ESTABLISHED OVER HALF A CENTURY.

Gas Engineers, Ironfounders, & Contractors,

Manufacturers of *GASHOLDERS and TANKS, BOILERS and ENGINES, ROOFS, EXHAUSTERS, BREEZE SCREENS, CHARGING and COKE BARROWS.*



Manufacturers of *PATENT WASHERS, PATENT VALVES for PURIFIERS, &c., GOVERNORS, LAMP COLUMNS, Weighbridges, COKE BREAKERS.*

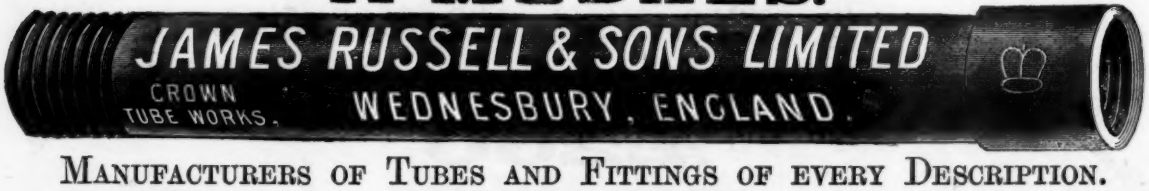
SOLE MAKERS OF COCKEY AND SMITH'S PATENT SELF-ACTING BYE-PASS VALVES.

Estimates for any description of Gas Plant on application.

THE IRON-WORKS, FROME SELWOOD, SOMERSET.

HIGHEST AWARDS—LONDON, PARIS, COLOGNE, VIENNA, MELBOURNE, AND OTHERS.

—11 MEDALS.—



MANUFACTURERS OF TUBES AND FITTINGS OF EVERY DESCRIPTION.

WROUGHT-IRON OR STEEL MAINS UP TO 6 FEET DIAMETER, FOR GAS, WATER, OIL, OR OTHER PURPOSES.

SCREWING TACKLE, BOILER MOUNTINGS, VALVES, COCKS, ETC.

LONDON: 108, Southwark Street. BIRMINGHAM: 114, Colmore Row. LEEDS: 6, Mark Lane, New Briggate.

THOMAS PIGGOTT & CO.,

(ESTABLISHED 1822)

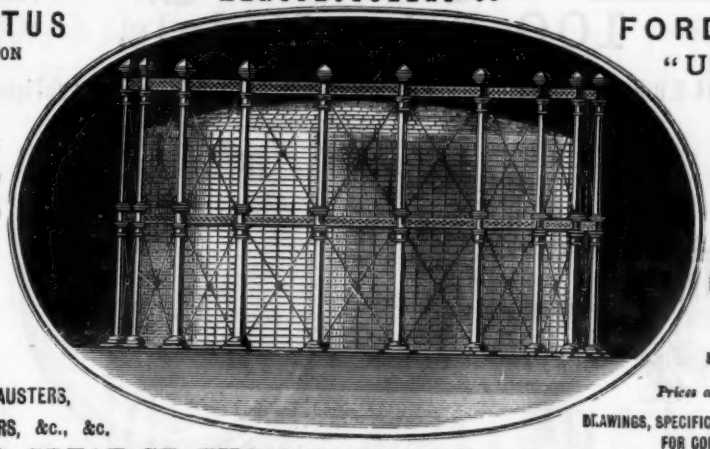
SPRING HILL, BIRMINGHAM,

MANUFACTURERS OF

GAS APPARATUS
OF EVERY DESCRIPTION
INCLUDING
GASHOLDERS
and Tanks,
Retorts, Purifiers,
Valves, Scrubbers,
Condensers,
ETC., ETC.

All of the most approved Designs.

BOILERS, ENGINES, PUMPS,
BEALE'S and other EXHAUSTERS,
METERS, GAUGES, GOVERNORS, &c., &c.



FORD'S PATENT
"UNIVERSAL"
SCRUBBER-
WASHER.
Numbers at work, giving excellent results.
No Motive Power Required.

ALSO OF
SOMERVILLE'S PATENT
RETORT MOUTHPIECES
AND
SELF-SEALING LIDS.
NO LUTING REQUIRED.

Prices and Particulars on application.

DRAWINGS, SPECIFICATIONS, AND ESTIMATES PREPARED FOR COMPLETE GAS PLANT.

London Offices: 14, GREAT ST. THOMAS APOSTLE, E.C.—J. E. & S. SPENCER, Agents.

ESTABLISHED 1825.

GAS TUBES

MANUFACTURERS OF EVERY DESCRIPTION OF

IRON OR STEEL LAP-WELDED OR BUTT-WELDED TUBES

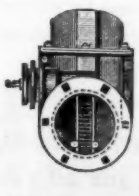
FOR ANY PURPOSE.

NEWTON, CHAMBERS, & CO., LIMITED,

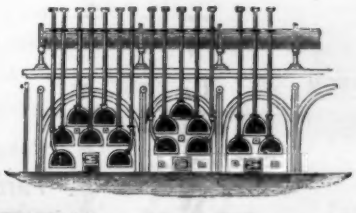
THORNCLIFFE IRON-WORKS, near SHEFFIELD,

MANUFACTURERS OF

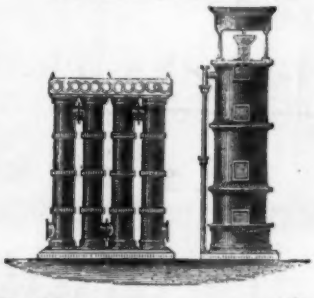
SLIDE VALVES,
WITH RACK & PINION,
OR
Internal or External
SCREWS, of all Sizes.
GASHOLDERS,
AND
Gasholder Tanks.



CAST-IRON RETORTS,
RETORT-BED FITTINGS,
And Retort-House Appliances
of every description.
Iron Roofs, Columns, Girders, Floor Plates
and Tools, &c.



WROUGHT AND CAST IRON
CONDENSERS,
SCRUBBERS, & WASHERS,
TAR AND LIQUOR PUMPS, &c.



PATENT
CENTRE VALVES
for working Purifiers.
Also Bye-Pass & Stop Valves.

PURIFIERS with Planed Joints,
HAND and HYDRAULIC LIFTING GEAR, CAST-IRON MAINS and SPECIALS
WOOD GRIDS.
CAST AND WROUGHT IRON TANKS AND CISTERNS.

DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

CROSSLEY'S "OTTO" GAS-ENGINE.

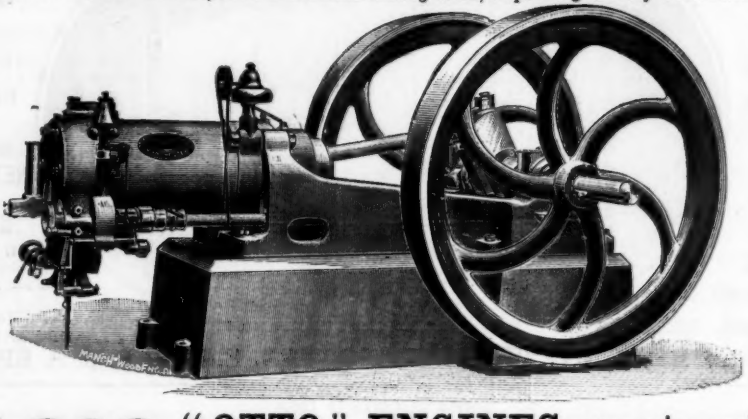
100 Prize Medals.

MADE in SIZES
2-Man to 100-HP.

GAS-ENGINES
COMBINED
WITH
PUMPS
FOR
TOWNS SUPPLY,
SEWAGE, &c., &c.

GAS-ENGINES
COMBINED
WITH
AIR COMPRESSORS
FOR THE
SHONE SEWAGE
SYSTEM, LUCIGEN
LIGHT, &c.

New 14-H.P. Nominal Size, fitted with Patent Tube Ignition, dispensing entirely with Plates.



MADE in SIZES
2-Man to 100-HP.

VERTICAL
AND
HORIZONTAL
TYPES.

ENGINES
COMBINED
WITH
HOISTS, PUMPS
DYNAMOS, &c. &c.

Largely used for
EXHAUSTING,
PUMPING,
COKE CRUSHING,
ELECTRIC LIGHTING,
&c., &c.

Over 31,000 "OTTO" ENGINES are at work.

CROSSLEY BROS., LTD., OPENSHAW, MANCHESTER,

LONDON,
LIVERPOOL,
GLASGOW,
NEWCASTLE,
BIRMINGHAM,
HULL.

HARRIS & PEARSON,
STOURBRIDGE, ENGLAND.
MANUFACTURERS OF
FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.
GLAZED BRICKS AND PORCELAIN BATHS.

W. C. HOLMES & CO.,

CONTRACTING GAS ENGINEERS.

SPECIALITIES.

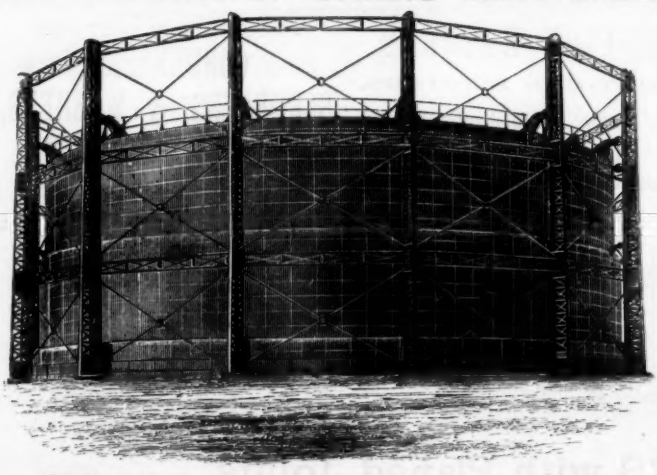
Patent Regenerative Retort-Settings.

Patent Rotary Scrubber-Washer.

Patent Reciprocating Exhauster.

Patent Regulator.

Patent Anti-Dip Pipes.



Treble-Lift Gasholder, 130 ft. by 66 ft., as erected at Burton-on-Trent, 1889.

SOLE MAKERS OF
DRAKE'S
PATENT
GAS PLANT
Specially adapted for Country Places, and for mixing with Coal Gas to increase Illuminating Power.

Condensers, Scrubbers, Purifiers, and all Fittings for Gas-Works.

IMPROVED
CHEMICAL PLANT.

WHITESTONE IRON-WORKS,
HUDDERSFIELD,
AND
80, CANNON STREET, LONDON, E.C.

Telegrams:
"Holmes Huddersfield."
"Ignitor London."

Illustrated Catalogues on application.

SULPHATE OF AMMONIA.

By Her Majesty's Royal Letters Patent.

DR. FELDMANN'S APPARATUS

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICES, APPLY TO THE

Sole Agents and Manufacturers,

GODDARD, MASSEY, & WARNER,
ENGINEERS,
NOTTINGHAM.

The Apparatus has been supplied to the following Firms—

BURT, BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (4 Apparatus).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

And to the following Gas Companies and Corporations—

ILKESTON.	BURY.	CHORLEY.
WIDNES	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'.	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS.
DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
HUDDERSFIELD.	ORMSKIRK.	LUTON.
		HAMPTON COURT.

PATENT GALVANIZED ROOFING.

Specially Suitable for Gas-Works.

G. R. HISLOP, Gas Engineer, Paisley, writes:—

"I have much pleasure in certifying entire satisfaction with your Patent Galvanized Arc Sheet Roofing with Steel Tube Joints, as supplied and erected by you here last autumn.

"While presenting a much more pleasing and substantial appearance, your system is in other respects more satisfactory than the ordinary Corrugated Iron; and such being the case, it is proposed to adopt it for other Roofs yet to be erected.

"*March 5, 1890.*"

We contract to cover Buildings with our Patent Roofing on any Iron or Wood Framing, or supply and erect complete Buildings or Roofs.
Gas Engineers are invited to ask us for Plans and Estimates.

No Holes in these Sheets.
Always Water-Tight.

The Iron and Steel Fencing and Buildings Company, Limited,
109, ST. VINCENT STREET, GLASGOW,
Manufacturers of Tanks, Cisterns, & Fencing Material.

THE PERFECT CARBON LIGHT.

(WALLIS-RATCLIFF'S PATENTS.)

J. KIDD & CO.,
GAS ENGINEERS,

Contractors to H.M. Office of Works, War Office, and School Board for London,

HAVE REMOVED FROM FARRINGDON STREET TO

44, Gray's Inn Road, Holborn, W.C.

GENERAL GAS LIGHTING, FITTINGS, BURNERS, &c.

Wallis's Patent Asbestos Shades and Improved Paper Shade Fittings.

H. E. A. WALLIS, Manager.

CUTLER'S PATENT
Guide-Framing for Gasholders.

STRONG. SAFE. CHEAP.

Copy of Letter received from TUNBRIDGE WELLS GAS COMPANY.

Gas Company's Offices, Tunbridge Wells,
April 1, 1890.

Dear Sirs,

I am instructed by the Directors to express their great satisfaction with the Gasholder you constructed for this Company last year, and which is provided with your PATENT SYSTEM OF GUIDE-FRAMING.

The Engineer has reported very favourably, not only of the work itself, which is excellent but of the merits of the PATENT GUIDE-FRAMING, which he thinks fully justifies all you claim for it.

The Directors also appreciate the liberal way in which you interpreted your obligation as to the strength of the material to be used, which, now that the work is completed, is found to be no doubt stronger than it need have been; but inasmuch as our Gasholder was the first to which the System had been applied, they think you did wisely in not reducing the material to the limits which are no doubt perfectly possible in such a Guide-Framing.

I am, Dear Sirs, yours truly,

(Signed) JOHN READ, Secretary.

Messrs S. CUTLER & SONS,
Great George Street Chambers,
16, Great George St., Westminster, S.W.

JOSEPH CLIFF & SONS,

INCORPORATED IN
THE LEEDS FIRE-CLAY COMPANY, Ltd.,
WORTLEY, LEEDS.

LONDON Offices & Depôts:
Baltic Wharf, Waterloo Bridge.
WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.
LIVERPOOL:
16, Lightbody Street.
LEEDS:
Queen Street.

MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

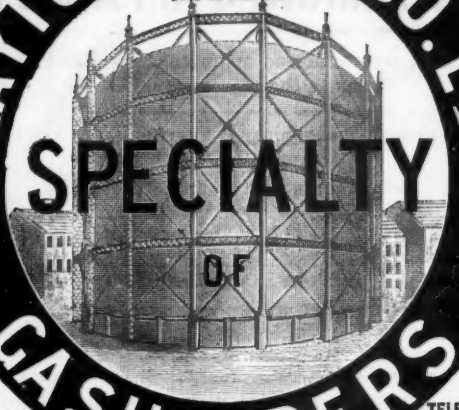
ESTABLISHED MORE THAN A QUARTER OF A CENTURY.

WORKS HUNSLET, LEEDS

LONDON OFFICE: 60, QUEEN VICTORIA STREET E.C.

CLAYTON SON & CO. LTD.

MAKE A SPECIALTY OF GASHOLDERS



AND MAKERS OF GAS PLANT OF EVERY DESCRIPTION.

REG? TELEGRAPHIC ADDRESS: "GAS LEEDS"

JOHN BROWN & CO., LIMITED,

ATLAS STEEL AND IRON WORKS, SHEFFIELD,

ALDWARKE MAIN GAS COAL.

This Coal yields 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.

R. & J. DEMPSTER,

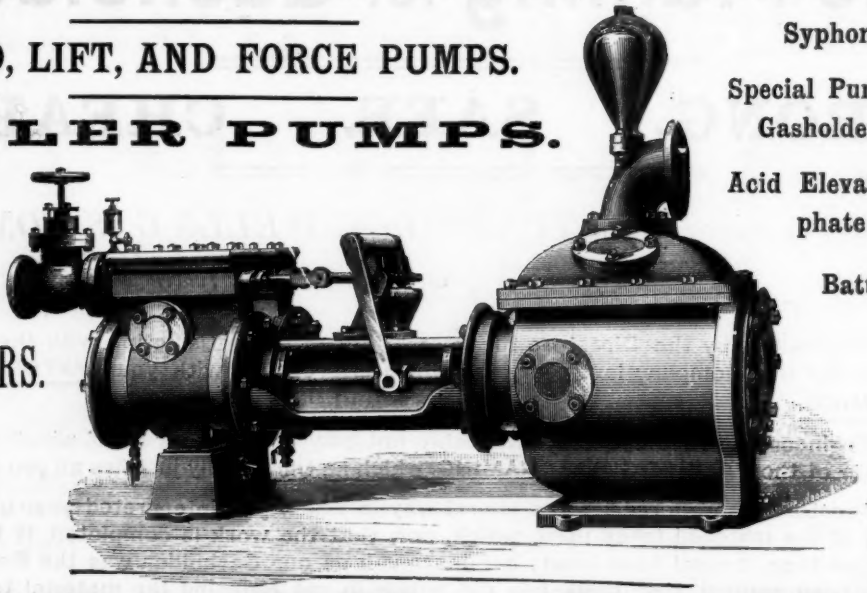
Engineers, Ironfounders, and Contractors,

GAS PLANT WORKS, NEWTON HEATH, MANCHESTER.

HAND, LIFT, AND FORCE PUMPS.

BOILER PUMPS.

PUMPS For SCRUBBERS.



Syphon Pumps.

Special Pumps for deep Gasholder Syphons.

Acid Elevator for Sulphate Plants.

Battery Pumps.

DUPLEX PUMPS

FOR

TAR, AMMONIACAL LIQUOR, OR CLEAN WATER.

LONDON OFFICES: 181, GRESHAM HOUSE, OLD BROAD STREET, E.C.

KIRKHAM, HULETT, & CHANDLERS' LTD.,

NEW PATENT "STANDARD" WASHER.

KIRKHAM, HULETT, & CHANDLER, Ld., have the pleasure to draw the attention of Gas Engineers and others interested in the question of the extraction of Ammonia and other Impurities from Coal Gas to their NEW PATENT "STANDARD" WASHER-SCRUBBER, which is being rapidly adopted by the Gas World, as shown by the following list, which comprises orders received for new "Standard" Washer-Scrubbers fitted with the improved "Wooden Bundles," and Machines supplied in past years renewed by substituting the same in place of the "Iron Bundles":—

NEW WASHER-SCRUBBERS.

The Gaslight and Coke Company—	Capacity in c. ft. per 24 hours.
Kensal Green Station	3,000,000
" "	3,000,000
Liverpool	3,000,000
Glasgow	2,500,000
"	2,500,000
Leicester	2,250,000
West Ham	3,000,000
Melbourne	1,500,000
Valparaiso (South America)	600,000
Barry and Cadoxton	500,000
Workington	500,000
Charlottenburg (Germany)	1,500,000
Magdeburg "	750,000
Erfurt	400,000
Rawmarsh	200,000
Derby	1,500,000
"	1,000,000
Vercelli (Italy)	200,000
Lowestoft	500,000

RENEWALS.

The Gaslight and Coke Company—	Capacity in c. ft. per 24 hours.
Beckton Station	1,250,000
" "	2,500,000
Nine Elms " (in part)	3,000,000
Shoreditch " "	2,500,000
Pimlico " "	2,000,000
The South Metropolitan Gas Company—	
Vauxhall Station (in part)	3,000,000
Birmingham	5,000,000
Kingston-on-Hull	400,000
Maidstone	1,000,000
Croydon	1,500,000
Melbourne	1,500,000
"	1,500,000
West Ham	1,500,000
Edinburgh	1,500,000

Testimonial from the Chief Engineer of The Gaslight & Coke Co.

The Gaslight and Coke Company, Horseferry Road, Westminster, S.W.,

Messrs. Kirkham, Hulett, and Chandler, Limited, *Nov.* 25, 1889.

Gentlemen,—In reply to your enquiry respecting the result of putting "Wooden Bundles" into some of the Washer-Scrubbers at our Beckton Station, I beg to say they have answered admirably for the few months they have been in; and I think them a decided success.—I am, yours truly,

(Signed) G. C. Trewby.

NOTE.—The first Washer referred to in the above was fitted with improved "Bundles" in May, 1888; and these have proved so satisfactory that The Gaslight and Coke Company have had several other "Standard" Washers fitted in the same manner, and have recently given an order for machines for 6,000,000 cubic feet per day.

396 "Standard" Washer-Scrubbers supplied (and in course of construction), equal to a daily capacity of 359,560,000 cubic feet of Gas.

PALACE CHAMBERS, BRIDGE STREET,

WESTMINSTER, S.W.

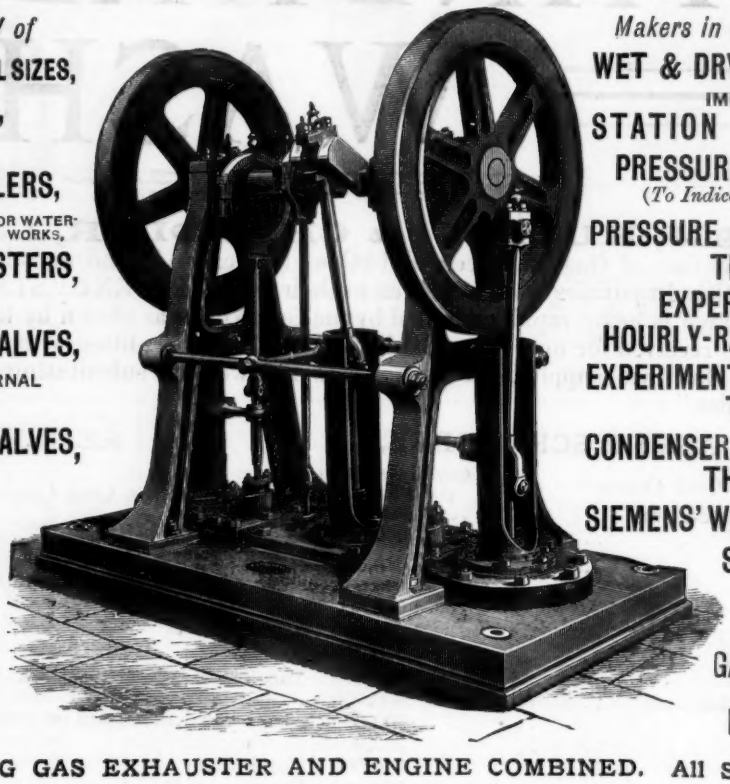
R. LAIDLAW & SON,

GAS AND WATER ENGINEERS.

Manufacturers of **GAS APPARATUS** of every Description.

Makers in GLASGOW of

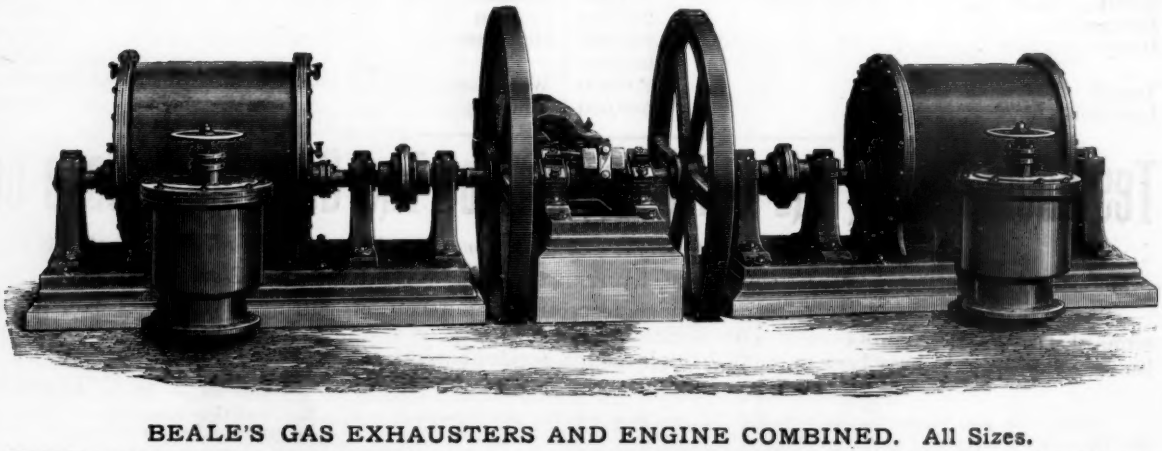
CAST-IRON PIPES, ALL SIZES,
LAMP PILLARS,
STEAM-ENGINES AND BOILERS,
PUMPING ENGINES FOR WATER-WORKS,
BEALE'S GAS EXHAUSTERS,
DOUBLE-FACED SLUICE VALVES,
INTERNAL AND EXTERNAL RACK OR SCREW SLIDE VALVES,
CAST-IRON COLUMNS,
BEAMS, GIRDERS, AND WATER-TANKS,
WROUGHT-IRON TUBES, FITTINGS, &c.



Makers in EDINBURGH of

WET & DRY GAS-METERS,
IMPROVED STATION GOVERNORS,
PRESSURE REGISTERS (*To Indicate New Time*),
PRESSURE GAUGES,
TEST HOLDERS,
EXPERIMENTAL HOURLY-RATE METERS,
EXPERIMENTAL TEST METERS,
CONDENSER THERMOMETERS,
SIEMENS' WATER-METERS,
STREET LANTERNS,
And all Kinds of GAS APPARATUS AND FITTINGS, &c.

PUMPING GAS EXHAUSTER AND ENGINE COMBINED. All Sizes.



BEALE'S GAS EXHAUSTERS AND ENGINE COMBINED. All Sizes.

Prices, with full Particulars, will be given on application.

Two Gold Medals, One Silver Medal, One Bronze Medal, and Two Honourable Mentions,

INTERNATIONAL EXHIBITION, EDINBURGH, 1886.

ALLIANCE FOUNDRY, **GLASGOW.** | SIMON SQUARE WORKS, **EDINBURGH.** | 6, LITTLE BUSH LANE, **LONDON, E.C.**

TANGYES LIMITED,

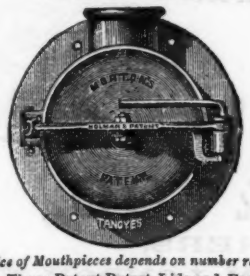
CORNWALL WORKS, BIRMINGHAM.

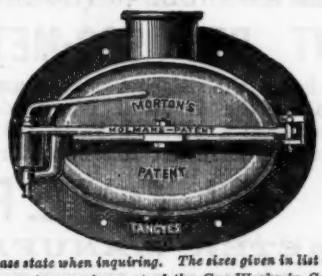
DEPÔTS AT

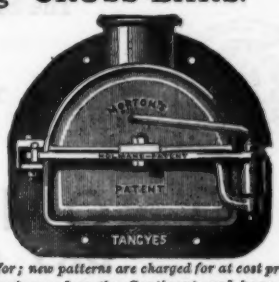
LONDON . . . . 35, QUEEN VICTORIA ST., E.C. | MANCHESTER . . . . . DEANSGATE
NEWCASTLE-ON-TYNE ST. NICHOLAS BUILDINGS | GLASGOW . . . . . ARGYLE STREET

Sole Makers of **MORTON'S** Patent Self-Sealing **RETORT-LIDS,**

With Anti-Friction CATCHES, and Self-Sustaining CROSS-BARS.







Price of Mouthpieces depends on number required, which please state when inquiring. The sizes given in list we have patterns for; new patterns are charged for at cost price.

These Patent Retort Lids and Fastenings are in extensive use in most of the Gas-Works in Great Britain, America, and on the Continent, and have almost entirely displaced the older method of sealing by a luting of lime or other material. The Lids are made in three forms, D, oval, and round (as shown above), in each of which we have a very extensive variety of patterns, from which Gas Engineers contemplating the adoption of these lids are recommended to make their selection, in order to avoid cost of pattern making, delays, &c., &c.

Mouthpieces with Circular Lids for Oval Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	PRICE, Lid and Fittings without Mouthpiece.
13658	14 ins.	14 × 12 ins.	15 ins.	£0 19 0
4356	14 ,,	18½ ,, 12 ,,	12½ ,,	0 19 0
6851	15 ,,	16 ,, 14 ,,	13 ,,	1 0 0
3629	15 ,,	18½ ,, 13½ ,,	14 ,,	1 0 0
3580	15 ,,	21 ,, 15 ,,	15 ,,	1 0 0
6264	16 ,,	18½ ,, 15½ ,,	15½ ,,	1 1 0
5210	16 ,,	20 ,, 14 ,,	15 ,,	1 1 0
6263	16 ,,	24 ,, 16 ,,	18½ ,,	1 1 0
5370	17 ,,	20 ,, 14 ,,	14 ,,	1 3 0
6832	17 ,,	20 ,, 14 ,,	17 ,,	1 3 0
6183	17 ,,	20 ,, 15 ,,	15 ,,	1 3 0
4289	17 ,,	21 ,, 15 ,,	14 ,,	1 3 0
5270	17 ,,	22 ,, 14 ,,	14 ,,	1 3 0
3631	18 ,,	18 ,, 14 ,,	20 ,,	1 5 0
3681	18 ,,	21 ,, 14 ,,	18½ or 15 ,,	1 6 0
3554	18 ,,	21 ,, 15 ,,	14½ ,,	1 5 0
7957	18 ,,	22 ,, 16 ,,	14 ,,	1 5 0
8048*	19 ,,	25½ ,, 15 ,,	18 ,,	1 8 6

Mouthpieces with Oval Lids for Oval Retorts.

Pattern No.	Dimensions of Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	PRICE, Lid and Fittings without Mouthpiece.
9800	18 × 14½ ins.	18 × 14½ ins.	15 ins.	£1 5 0
9205	20 ,, 19 ,,	24 ,, 14 ,,	10½ ,,	1 10 0
10009	20½ ,, 14½ ,,	20½ ,, 14½ ,,	15 ,,	1 10 0
9680	21 ,, 15 ,,	21 ,, 15 ,,	15 ,,	1 12 0
10056	21 ,, 14½ ,,	21 ,, 14½ ,,	15½ ,,	1 12 0
13218	21 ,, 15 ,,	21 ,, 15 ,,	17 ,,	1 12 0
10514	23½ ,, 18½ ,,	23½ ,, 18½ ,,	18½ ,,	1 13 0
13766	20 ,, 17 ,,	20 ,, 17 ,,	15½ ,,	1 15 0
13269	24 ,, 15 ,,	24 ,, 15 ,,	18 ,,	1 18 0

190

Mouthpieces for Round Retorts.

Diam. .. .. ins.	14	15	16	17	18
Price, Lid and Fittings without Mouthpiece } £	0 19 0	1 0 0	1 1 0	1 3 0	1 5 0

Mouthpieces with Circular Lids for D Retorts.

Pattern No.	Diam. Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	PRICE, Lid and Fittings without Mouthpiece.
5348	14 ins.	14 × 13 ins.	7 ins.	£0 19 0
3463	15 ,,	15 ,, 13 ,,	14 ,,	1 0 0
6678	15 ,,	15 ,, 14 ,,	12 ,,	1 0 0
3661	15½ ,,	15½ ,, 13 ,,	12 ,,	1 1 0
13052	16 ,,	16 ,, 13 ,,	18 ,,	1 1 0
5601	16 ,,	16 ,, 14 ,,	15 ,,	1 1 0
6827	16 ,,	16 ,, 14 ,,	17 ,,	1 1 0
4494	16 ,,	16 ,, 14 ,,	14 ,,	1 1 0
3548	16 ,,	16 ,, 15 ,,	12½ ,,	1 1 0
6677	16 ,,	16½ ,, 13½ ,,	12½ ,,	1 1 0
9645	16 ,,	16½ ,, 13½ ,,	12½ ,,	1 1 0
4434	16 ,,	17½ ,, 14 ,,	14 ,,	1 1 0
6469	16 ,,	18 ,, 14 ,,	15 ,,	1 1 0
9015	16 ,,	18 ,, 14 ,,	18½ ,,	1 1 0
4327	16 ,,	18 ,, 15 ,,	15½ ,,	1 1 0
8049*	16 ,,	18 ,, 15 ,,	17½ ,,	1 1 0
6137	16 ,,	20½ ,, 13½ ,,	13½ ,,	1 1 0
5918	17 ,,	18 ,, 14 ,,	14 or 17 ,,	1 3 0
5053	17 ,,	19½ ,, 12 ,,	14½ ,,	1 3 0
7548	17 ,,	20 ,, 13 ,,	15 ,,	1 3 0
6468	17 ,,	20 ,, 16 ,,	15½ ,,	1 3 0
4316B	17 ,,	21 ,, 14 ,,	14 ,,	1 3 0
7975	17 ,,	21 ,, 15 ,,	14½ ,,	1 3 0
13459	17 ,,	21½ ,, 13½ ,,	15 ,,	1 3 0
12990	18 ,,	18 ,, 15 ,,	15 or 19 ,,	1 5 0
7135	18 ,,	18½ ,, 15 ,,	13 ,,	1 5 0
10221	18 ,,	18 ,, 16 ,,	12½ ,,	1 5 0
4506	18 ,,	20 ,, 13 ,,	19½ ,,	1 5 0
6470	18 ,,	20 ,, 13 ,,	15 ,,	1 5 0
6818	18 ,,	20 ,, 13½ ,,	17½ ,,	1 5 0
4083	18 ,,	20 ,, 15 ,,	16 ,,	1 5 0
5306	18 ,,	20½ ,, 14 ,,	13½ ,,	1 5 0
13295	18 ,,	20½ ,, 14 ,,	19½ ,,	1 5 0
7356	18 ,,	20½ ,, 13½ ,,	13 ,,	1 5 0
4569	18 ,,	21 ,, 14 ,,	18 ,,	1 5 0
3628	18 ,,	21 ,, 15 ,,	16 ,,	1 5 0
7640	18 ,,	22 ,, 12½ ,,	13½ ,,	1 5 0
7971*	20 ,,	20 ,, 15 ,,	18 ,,	1 11 0

*Patterns marked * have Sockets at back to connect to Retorts; all the others are flanged. Patterns marked B have curved bottoms.* 191

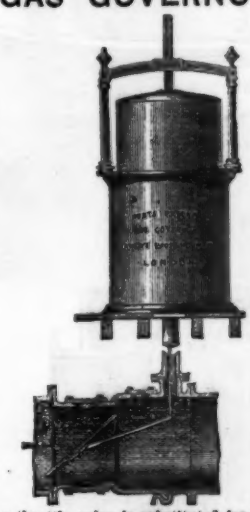
Mouthpieces with D Lids for D Retorts.

Pattern No.	Dimensions of Mouth.	Internal Dimensions of Retort.	Length of Mouthpiece.	PRICE, Lid and Fittings without Mouthpiece.
12292	15½ × 13 ins.	15½ × 13 ins.	12 ins.	£1 2 0
9967	16 ,, 14 ,,	16 ,, 14 ,,	15½ ,,	1 3 0
13574	16½ ,, 13½ ,,	16½ ,, 13½ ,,	19½ ,,	1 4 0
9899	18 ,, 12 ,,	18 ,, 12 ,,	14 ,,	1 4 0
12980	16 ,, 16 ,,	16 ,, 16 ,,	18 ,,	1 6 0
13900	18 ,, 13½ ,,	18 ,, 13 ,,	15 ,,	1 6 0
9912	18 ,, 13½ ,,	18 ,, 13½ ,,	17 ,,	1 6 0
9962	18 ,, 13½ ,,	18 ,, 13½ ,,	16 ,,	1 6 0
10982	18 ,, 13½ ,,	18 ,, 14 ,,	15 ,,	1 6 0
11098	18 ,, 14 ,,	18 ,, 14 ,,	12 ,,	1 6 0
9492	20 ,, 13 ,,	20 ,, 13 ,,	15 ,,	1 10 0
9208	20 ,, 13 ,,	20 ,, 13 ,,	19½ ,,	1 10 0
10251	20 ,, 13 ,,	20 ,, 13 ,,	15½ ,,	1 10 0
12964	20 ,, 13 ,,	20 ,, 13 ,,	13½ ,,	1 10 0
9909	20 ,, 13½ ,,	20 ,, 13½ ,,	17 ,,	1 10 0
12969	19½ ,, 15½ ,,	19½ ,, 15½ ,,	14 ,,	1 11 0
13781	20 ,, 15 ,, Front. / 21 ,, 15 ,, Back.	21 ,, 15 ,,	15 ,,	1 11 0
7692	21 ,, 15½ ,,	21 ,, 15½ ,,	16 ,,	1 11 0
12978	20 ,, 16 ,,	20 ,, 16 ,,	17 ,,	1 11 0
13252	20 ,, 16 ,,	20 ,, 16 ,,	18 ,,	1 11 0
13220	21 ,, 15 ,,	21 ,, 15 ,,	17 ,,	1 11 0
8977	21½ ,, 13½ ,,	21½ ,, 13½ ,,	18½ ,,	1 11 0
8976	21½ ,, 13½ ,,	21½ ,, 13½ ,,	18½ ,,	1 12 0
10497	21½ ,, 13½ ,,	21 ,, 15½ ,,	18½ ,,	1 12 0
8037	21½ ,, 13½ ,,	21½ ,, 13½ ,,	18½ ,,	1 12 0
9908	21½ ,, 13½ ,,	21½ ,, 13½ ,,	15 ,,	1 12 0
10404	21½ ,, 13½ ,,	22 ,, 14 ,,	18½ ,,	1 12 0
12410	21½ ,, 13½ ,,	22 ,, 14 ,,	12 ,,	1 12 0
13822	21½ ,, 13½ ,,	22 ,, 14 ,,	15 ,,	1 12 0
10515	22½ ,, 12½ ,,	22½ ,, 12½ ,,	18½ ,,	1 12 0
7924	24 ,, 14 ,,	24 ,, 14 ,,	16½ ,,	1 13 0
13807	24 ,, 15½ ,,	24 ,, 15½ ,,	16 ,,	1 14 0
9015B	25 ,, 14 ,,	25 ,, 14 ,,	19½ ,,	1 14 0
10932	25 ,, 14 ,,	24 ,, 14 ,,	18½ ,,	1 15 0
12944B	22 ,, 16 ,,	22 ,, 16 ,,	16 ,,	1 15 0

Patterns marked B have curved bottoms. 193

HUNT'S PATENT EQUILIBRIUM DIRECT MAIN

GAS GOVERNOR.



In this Governor a throttle valve is substituted for the ordinary suspended cone; all external communication being avoided by placing the lever or radius arm inside the valve chamber upon the disc.

The disc is carried upon steel centres, upon which it is accurately balanced.

4 ins. ...	£17 0	8 ins. ...	£25 0	14 ins. ...	£42 0	20 ins. ...	£80 0
5 ,, ..	20 0	10 ,, ..	33 0	16 ,, ..	48 0	24 ,, ..	72 0
6 ,, ..	22 10	12 ,, ..	38 0	18 ,, ..	50 0	36 ,, ..	130 0

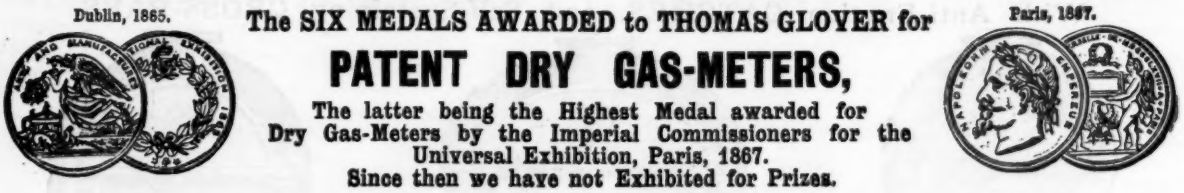
195

[Copyright, Entered at Stationers' Hall.

ESTABLISHED 1844.] **ORIGINAL MAKERS.** [ESTABLISHED 1844.]

London, 1851. New York, 1853. Paris, 1855. London, 1862.

Dublin, 1865. Paris, 1867.



The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.
Since then we have not Exhibited for Prizes.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

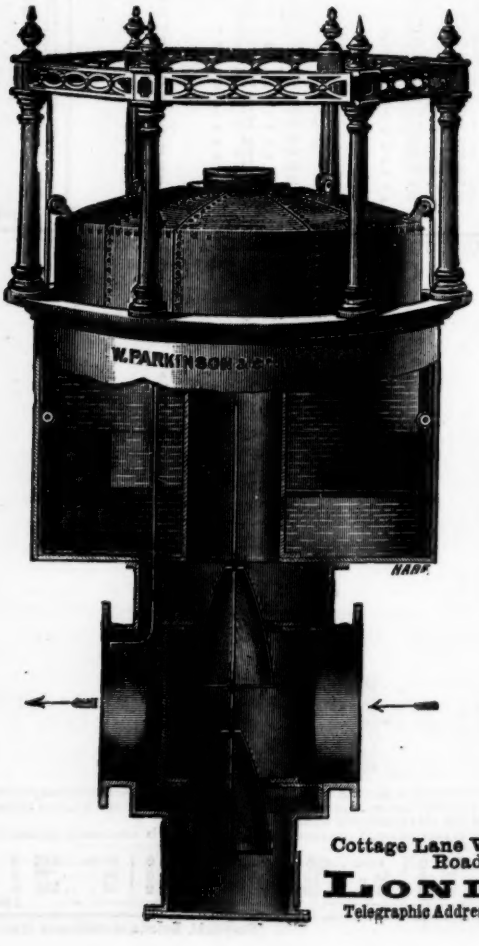
214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

And at 37, BLACKFRIARS STREET, MANCHESTER.

TELEGRAPHIC ADDRESSES: "GOTHIC LONDON," "GOTHIC MANCHESTER." TELEPHONE No. 6725.

1st—Are a remedy for all the defects of Wet Meters.
2nd—Are suitable for all climates, whether hot or cold.
3rd—Incur no loss of Gas by Evaporation.
4th—Cannot become fixed by Frost, however severe.
5th—Are the most accurate and unvarying measurers of Gas.
6th—Prevent jumping or unexpected extinction of the Lights.
7th—May be fixed either above or below the level of the Lights.
8th—Cannot be tampered with without visibly damaging the outer case.
9th—Will last much longer than Wet Meters.
10th—Will not cost more than one-half for repair that Wet or Water Meters do.

Are upheld for five years without charge.



PARKINSON'S

PATENT

EQUILIBRIUM GOVERNORS.

A very large number are now dt work; and all Engineers who have adopted them speak in unqualified terms of their great efficiency.

COUNTERBALANCE or AIR VESSEL, as desired.
TWO, FOUR, or SIX COLUMNS and GIRDERS.
WEIGHTS or WATER PRESSURE.

Cottage Lane Works, City Road, **LONDON.** Telegraphic Address: "Index."

Bell Barn Road Works, **BIRMINGHAM.** Telegraphic Address: "Gas-Meters."

Office: 10, Mawson's Chambers, Deansgate, **MANCHESTER.** Telegraphic Address: "Precision."

CONTENTS.

EDITORIAL NOTES:—
GAS, LIGHTING, &c.— PAGE
The Leeds Surrender . . . 71
Papers at The Gas Institute Meeting . . . 72
Rejected Gas Bills . . . 73
WATER AND SANITARY AFFAIRS—
Mr. Causton's Bill for the Regulation of Water Companies' Charges . . . 73
The Inquiry into the Water Supply of the Metropolis—A Water Consumer and His Charges . . . 73
THE GAS INSTITUTE—Twenty-Seventh Annual Meeting:—
Papers and Discussions—
Self Charging and Discharging Inclined Retorts. By Messrs. Coze and Van Vestraut, of London . . . 74
On the Principles involved in the Construction of the Northwich Gasholder. By W. Gadd, of Manchester . . . 78
On Wire Rope in Place of Rigid Framing for Gasholders. By E. Lloyd Pease, of Darlington . . . 81
ESSAYS, COMMENTARIES, AND REVIEWS:—
Gas and Water Companies in the Stock Market . . . 83
Electric Lighting Memoranda . . . 84
Accidents with Mineral-Oil Lamps . . . 84
NOTES:—
The Question of the Coal Supply . . . 86
Cause of the Violet Flame of Salt on Burning Coal . . . 86
Processes for Preserving Iron from Rust . . . 86
TECHNICAL RECORD:—
Société Technique du Gaz en France—The Annual Congress at Lyons . . . 87
The Board of Trade and Electric Lighting . . . 88
REGISTER OF PATENTS:—
Distillation, &c., of Ammoniacal and Other Liquids—Solvay and Co. . . . 90
Gas-Cocks—Hamer, F. G. . . . 90
Gas Motors—Rowden, W. T. . . . 90
Gas Engines—White, C., and Middleton, A. R. . . . 91
Retorts for Producing Gas—Sanders, F. . . . 91
Patent Notices . . . 91
CORRESPONDENCE:—
Mr. West and the Assistant Secretary of the Gas Workers' Union . . . 92
Stoking Arrangements at the Chester Gas-Works . . . 92
The Results Produced at Large and Small Gas-Works . . . 92
Naphtha for Imparting Illuminating Power to Water Gas . . . 92
"Steam" Washers . . . 92
PARLIAMENTARY INTELLIGENCE:—
House of Lords—Progress of Bills . . . 93
House of Commons—Progress of Bills: Water Companies' Charges Bill . . . 93
LEGAL INTELLIGENCE:—
Court of Session—Outer House—Owens and Son *v.* Bo'ness Gas Company . . . 93
Norwich Guildhall—Intimidating Gas Workmen . . . 93
MISCELLANEOUS:—
The Strike of Gas Stokers at Leeds—Disgraceful Scenes; Meetings of the Council; A Settlement Effected; Press Comments . . . 94
Manchester Corporation Gas Supply—The Gas Committee's Report Adopted; The Annual Accounts . . . 98
Edinburgh and Leith Gas Undertakings—The Annual Accounts . . . 100
Rotherham Corporation Gas-Works—The Prices and Sales of Coke . . . 101
Meeting of the Pará Gas Company, Limited . . . 101
Plymouth Gas Company—A Satisfactory Year's Working . . . 102
The Salford Corporation and their Lever Action—Proceedings in the Town Council; Press Comments . . . 102
Damage to Gas-Pipes by Lightning at Filey . . . 103
The Future of Gas in America . . . 103
The Electric Lighting Movement at Bromley (Kent)—The Comparative Cost of Gas and Electricity . . . 104
Metropolitan Water Companies' Charges—Mr. Causton's Bill . . . 105
The Inquiry into the Water Supply of the City of London . . . 105
Notes from Scotland . . . 107
Current Sales of Gas Products . . . 108
Gas and Water Companies' Stock and Share List . . . 108

PARAGRAPHS.—Prohibition of Saccharine in Italy, 73—Mr. William Robinson, M.E.s 73—Mr. Trewby's Improved System of Charging Inclined Retorts, 73—Death of Sir E. Chadwick, 74—Messrs. John Wright and Co., Limited, 83—Resignation of Mr. T. Varley, of Colne, 83—The Automatic Coal-Gas Retort Company, Limited, 83—Mr. George Shepard Page, 85—Mr. T. R. Dickinson, Assoc. M. Inst. C.E., 85—Institution of Civil Engineers, 85—Gas-Works in Sweden, 85—Retirement of Mr. Charles Nettleton, of New York, 85—Pensions for Gas Workmen and their Widows, 85—Electric Lighting at Trient (Austria), 85—Paris Water Supply, 86—The Recovery of Sulphur from Alkali Waste, 86—Coal in South Africa, 86—Proposed Conversion of the North of Ireland Association of Gas Managers into a "National Association," 86—Society of Arts, 89—The Electric Light in Holland, 89—Water Supply in Mexico, 89—Lead-Poisoning in the Wakefield District, 92—Cookery Lectures in the Lake District, 92—The Brighton Electric Light Accident, 92—Water-Works Purchase Question at Andover, 92—Reading Corporation Water Department, 93—Serious Accident at the Rochdale Road Gas-Works of the Manchester Corporation, 93—Electric Lighting Works and Telephone and other Wires, 93—Gas, Water, and General Investment Trust, Limited, 98—Electric Lighting at Southport, 98—Sale of Shares, 98—The Fatal Accident at the Blackpool Gas-Works, 98—Gas Managers and Ambulance Work, 98—Increase in the Price of Gas for the Public Lighting of Richmond, 98—Gas Exhibition at Bromley, 98—Gas Explosion and Fire in a Subway Manhole in New York, 98—S. Z. de Ferranti, Limited, 100—The New River Company's Shares, 100—Salford Gas Matters, 100—The Richmond Well, 100—The Northern Coal Trade, 100—The Pollution of Rivers, 100—The Sale of Coke at the Stockport Gas-Works, 101—The "Hunter Compact," 104—The Lancashire Coal Trade, 105—New Joint-Stock Companies, 105—Increase in the Price of Gas at Oldham, 105—Burnley Corporation Gas Supply, 105—Exhibitions of Gas Appliances, 108.

NOTICE TO SUBSCRIBERS
AS TO PAYMENT OF SUBSCRIPTIONS IN ADVANCE.

Subscribers who desire to avail themselves of the reduction in the Subscription to the JOURNAL by paying in advance for the second half of the Year, are reminded that this can only be done during the present month.

The Subscription is at the rate of 21s. a year paid in advance, or 25s. if credit be taken.

THE
JOURNAL OF GAS LIGHTING,
WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JULY 8, 1890.

The Leeds Surrender.

THE Leeds strike, and the capitulation of the Corporation Gas Committee, are the events of the past week. In another place will be found a full report of the whole affair. It is not our desire to make any comments upon this miserable business in condemnation of the acts of the Gas Committee, beyond what are thoroughly deserved. It is evident that the whole story of the Leeds strike has not yet been told, and that some of the superior officials and leading members of the Committee could say something about difficulties without and dissensions within that rendered the capitulation inevitable. The Committee and the Town Council seem to have been half-hearted, and were therefore not in a position to make war successfully. However this may be, there can be but one verdict on the whole affair—the Gas Committee ought never to have begun what they were unable to carry through. They came to loggerheads with their men on certain points of new working rules, prominent among which was a requirement that the stokers should sign agreements to serve from October to January. The object of the Committee in formulating this condition was, of course, to prevent danger to the gas supply of the town through a strike in the winter. It is not quite clear, from the published narrative, when the Gas Workers' Union began to move in the matter; but, at any rate, it soon appeared that the Leeds stokers would not consent to the Committee's terms, and they artfully enough based their objections, not to that part of the scheme which was directed to the preservation of the gas supply, but to a section which they declared entailed an increase of their work. By this device the men were able to capture the sympathy of some of the townspeople and members of the Corporation who belong to the class that only asks half an excuse for siding with the populace. The Committee thereupon overrated their own strength, and made arrangements for locking out the rebellious hands and replacing them with imported labourers. There was no difficulty about this part of the programme. The superintendents of the different stations only wanted about 200 stokers; and three or four times as many could be found in London and Manchester among the victims of the strikes of last winter. These were taken on last week—many of them signing for a year. Unfortunately, the arrangements of the Committee broke down at the critical point. In his speech to the Town Council, after the affair was all over, Mr. Alderman Gilston said that "the forces of law and "order were hardly equal to defending the rights of the "citizens of the town"—which is a mild way of putting it. There was no gas in store, so the town suffered from want of light at the very beginning of the disturbance—a circumstance which naturally went against the Committee. Then for several days Leeds was given up—at least in the vicinity of the gas-works—to rioting and violence. From the first day of the lock-out, however, it could be seen that matters were all going against the Committee. Why so many of the imported hands left the works is a point that requires explanation. It is reported that nearly half the new drafts went away, and the others seem to have made a poor job of the stoking, which points to the existence of something very wrong inside the retort-houses. If the gasholders could have been kept afloat, the Committee might have been able to defy the powers of disorder long enough to have insisted on terms such as would have justified their action; but it was otherwise. With no gas inside, insufficient or badly generalized forces outside, and heads—such as they were—turned with fear of the mob, the Committee gave in. Mr. Thorne is the hero of the situation; and although threatened with prosecution for inciting to violence, probably thinks Leeds goes a long way to make good the damage done to the Gas Workers' Union by the Corporations of Manchester and Salford, and the South Metropolitan Gas Company.

The lesson of this deplorable affair is simple enough; yet, as many newspapers show, it may easily be mistaken. That the Corporation and the Gas Committee have made a wretched mess of it, is clear enough; and the rejoicings of the anarchist press correspond with the disgusted expressions of sober-minded observers in establishing the fact. At the same time, it is not fair that all the blame for the triumph of the mobocracy at Leeds should be laid to the circumstance that the gas-works are in the hands of a Local Authority. There is the example of Bristol to show that bad plans and feeble execution are not the monopoly of Corporation Committees; while Manchester and Salford prove that a determination to uphold a righteous cause, even at great cost and inconvenience, may be successfully carried out by elective bodies. Incapacity, unfortunately, is to be found everywhere, and in all shapes. The true lesson of Leeds for

gas administrators is that, in all their dealings with workmen, right and reason should be the guiding principles of their policy; and that disputes should never be allowed to proceed to the last extremity unless means exist for carrying the employers' policy to a successful issue. These counsels are almost truisms; but how do Bristol and Leeds bear their application? Whatever may have been the case formerly, a spirit is now abroad that does not grant, as a matter of course, the assumption that in all labour disputes the employers' view is the correct one. The old-fashioned type of storming, swearing, devil-driving "master" is obsolete. The community generally are quite prepared to concede to the wage-earner the right to protection against a good deal that he was once expected to put up with as a matter of course, and incidental to his position. This is perfectly right; but the public, in their newly-aroused sympathy for the wage-earners, are liable to be imposed upon by demagogues adroit in misrepresentation, who make a paying business of meddling in labour disputes. It is notorious that there are many men in this country who give all their time to this business, and find it agrees with them. The newspapers are open to their letters and speeches, and their art lies in figuring as the means of obtaining occasional benefits for the working man, while they take good care to prevent his being made too comfortable. These men pounce upon such opportunities as that of the promulgation of the Leeds regulations, and place them in a false light before the public, as they did with the South Metropolitan profit-sharing scheme and the utterly uncalled-for strikes in Manchester and Salford. In these cases, however, the position of the employers was so strong that misrepresentation proved as incapable of entrapping public sympathy as abuse was of shaking the purpose of the employers. When Mr. Chesters-Thompson declared in the Manchester City Council that it would be better that gas should never more be made in the Corporation works than that the wrong sought to be done by the men should be suffered, he had at his back a sentiment against which the misrepresentations of professional agitators could not prevail. This is what we mean when we insist upon the right being not only on the side of the employers in labour disputes, when the mob always raises the loudest shout, but being so conspicuously on their side that no amount of shouting can conceal the fact, and no sophistry, inspired by solicitude for the popular vote, can controvert the paramount necessity that right should be done.

Secondly, with regard to the power of gas-works administrators to carry an unavoidable labour dispute to a successful issue. Where the undertaking is public property, as in Manchester and Salford, if once the community perceive the rights of the dispute, as they did in this case, they will endure a considerable amount of inconvenience, and pardon a good deal of shortcoming on the part of their deputies of the executive department. It is naturally different with a Company, who could not expect their customers to suffer on their account. As a matter of fact, however, a remarkable feature of the South Metropolitan strike was the expressed willingness of gas consumers to support the Company on principle, by making sacrifices which, in the event, the completeness of the Company's preparations rendered unnecessary. Not even a Gas Committee of a Corporation could expect the community to bear with deprivation of light beyond a certain point; and hence it is of the first importance that any Committee, when brought face to face with a strike, should pause and reckon up their resources in men and materials. Have they plenty of gas-holder room? Are the retort-houses ample, easily worked, and sufficiently stocked with machinery and labour-saving appliances of the most approved description? Finally, and most important of all, have they a man, or men, anywhere who can be trusted to take a business of this kind in hand, and bring it to a successful issue? These are the times that try what a gas-works administration is made of. Any works, or congeries of works, that have been licked into something like shape by a competent engineer, can be trusted to go along tolerably well in a jog-trot style for a year or two in the hands of an amateur chairman and a few good works superintendents, just as a ship will steer herself for awhile in a gentle breeze with the helmsman nodding over the wheel. So it has been at Leeds. The Gas Committee have gone on in their own way, dropping money here and there; but as there was nobody in the Corporation who knew any better, their lack of headship was not found out before last week. It is when troubles come that the managing brain is wanted; but unless it is in its place beforehand, it is wanted in vain. There is a very good saying that whoever expects to have an umbrella when it rains must carry one when it is dry. The Leeds Corporation neglected this precaution, and have been thoroughly drenched.

Gas engineers, whose value is too often ignored by these cheaply-managed Corporation Committees, may well smile at the spectacle presented by Leeds, while they regret the evil consequences that are only too likely to follow from the momentary triumph of the forces of anarchy. Who is to warn a Committee like that of Leeds when the carbonizing plant is growing antiquated, when the gasholder room is becoming short, and when laborious methods of working can be replaced by reliable machinery? The Leeds Corporation have made their bed, and must lie on it. They have seen at last that cheap inefficiency comes terribly dear in the end; yet it is quite possible that, after all, they may fail to profit by the teaching of the fearfully expensive school through which they have been dragged by stern necessity. For the rest, it may unfortunately happen that the Gas Workers' Union will have to be taught once more that the game of law and order in England is not yet up, and that violence can be curbed in other places, even if for once it has gained the upper hand in Leeds.

The Papers at The Gas Institute Meeting.

THIS week we give the last of The Gas Institute papers—the communications that were unread being reserved to impart a little fresh interest to the volume of Transactions when it appears. Those now published, although the last to be brought before the meeting, are not by any means the least important of the contributions to the Institute for the year.

Mr. Van Vestraut was the only author of the trio whose communication was adequately discussed. It was exceedingly well put together; and considering that the writer is joint patentee with Mr. Morris of a means of adapting inclined retorts to English working conditions, which must be regarded in the light of an improvement on the Coze system, he was particularly fair in his dealings with M. Coze's arrangement. It is not often that the designer of an improvement on an invention is so restrained in advocating his own method as Mr. Van Vestraut, who was a pattern to patentees in his sparing use of the personal pronouns of which many of his kind are so fond. After hearing this paper, and remembering that Murdoch himself had a fancy for inclined retorts, it is not surprising that one cannot help wondering what gas manufacturers have been about all these years to let M. Coze and his English followers startle them thus. It was pleasant to see Mr. W. T. Carpenter, of Sheerness, whose work in this direction is too often ignored, taking part in the discussion. Mr. Van Vestraut paid a well-deserved compliment to Mr. Carpenter; but he was almost too polite in saying that, if that gentleman had persevered, he would have achieved success at last. In point of fact, Mr. Carpenter was before his time in attempting a method of carbonizing coal which could hardly have succeeded without the help of the gas-furnace for heating. The success of the Coze system is really a consequence of the adaptability of the gas generator furnace, which was not available in 1878 when Mr. Carpenter was struggling with his inclined setting at Sheerness. Moreover, the difference between M. Coze and Mr. Carpenter is precisely analogous to that between the early pioneers of mechanical stoking and Mr. West. Like them Mr. Carpenter attempted to do too much at once. Continuous carbonizing was his goal; but this desideratum did not enter into M. Coze's scheme. Where the latter succeeded was in only trying for one end; and where Messrs. Morris and Van Vestraut have lately triumphed is in translating M. Coze's ideas into the vernacular of British practice.

Mr. Gadd's paper, on the "Principles Involved in the "Construction of the Northwich Gasholder," was partly devoted to a mathematical proof of the security of the method of guiding gasholders wholly from the base, which the author has applied with practical success in the work named. It was, however, mainly concerned with Mr. Gadd's desire to establish an exclusive right of ownership in what he calls his "cantilever principle" of gasholder construction. This matter must stand where it is for the

present; but it may well be remarked that as the patent law does not recognize any man's property in a principle, but only in applications thereof, it would be more fitting if equal reserve were always observed in all public references to such subjects.

Mr. E. Lloyd Pease's paper on wire-rope framing for gasholders was praiseworthy in form as well as in substance. It dealt with questions not easily discussible in a public meeting; and the author in reading it was under the disadvantages of addressing a wearied audience, and of being interrupted by an interlude of ceremonial speech-making, which was not conducive to his efforts to keep the attention of his hearers. Mr. Pease, however, managed to convey the impression that his proposals for guiding gasholders by means of wire ropes are exceedingly ingenious; and the mention of the Haslingden and Manchester examples supplied that proof of actuality and validity so dear to the British Gas Manager's heart. As the consideration of a gasholder tank began the Ryde meeting, so it ended with descriptions of gasholder construction; having been occupied with sundry and various topics between. Carbonizing plant and gasholder work, indeed, supplied most of the technical matter of current interest and lasting value that will enrich the Transactions of the Institute for 1890.

Rejected Gas Bills.

THE rejection of the Whitehaven Gas Bill by the Lords Committee is not a very reassuring incident to those who have been in the habit of thinking that a Gas Act could be had at any time merely for the asking. Partick, Hillhead, and Maryhill failed to get their wished-for *status;* and now Whitehaven is in the same condition. Why? It would not be easy to prove the existence of anything like a general connection between these two examples, which are striking enough even if taken separately; yet it is difficult to avoid looking at them together. There were, doubtless, circumstances in the suburban Glasgow affair that are not repeated in the case of the Cumberland port; but one general remark applies to both—the Companies thought an Act would be a good thing for them, and the Committees thought it would be altogether too good, and more than they were rightly entitled to. This notion perhaps originates in a quickened perception on the part of the authorities who direct the course of the Legislature that a Gas Act is a very valuable thing, not to be given except for particular reason, especially if somebody with claims to be heard objects to anything of the kind. It is curious, after the advantages of incorporation with statutory powers have been preached by the advisers of Gas Companies, often vainly, for so many years, that the tables should be turned, and legislation invoked ineffectually by late aspirants. In the cases of both the Partick and the Whitehaven concerns, the Committees seemed to be fully possessed of the idea that they were asked to do something which would materially enhance the value of the Companies' property, without sufficient reason having been adduced for the bestowal of such a benefit. The example should not be thrown away on any lingering Companies that may yet secure their future if the duty is taken in hand in the proper manner.

Prohibition of Saccharine in Italy.—A decree made by the King of Italy on Sept. 29 last year, forbidding the introduction or production within the kingdom of saccharine and its products, has just been converted into law.

Mr. William Robinson, M.E., Senior Demonstrator of Electrical Engineering and Applied Physics at the City and Guilds of London Technical College, Finsbury, and author of the work on "Gas and Petroleum Engines" recently reviewed in the JOURNAL, was unanimously elected Professor of Engineering at the University College, Nottingham, at a meeting of the College Committee of Management held last Tuesday.

Mr. Trewby's Improved System of Charging Inclined Retorts.—In the JOURNAL for the 17th ult. we stated that Mr. G. C. Trewby, Engineer-in-Chief of The Gaslight and Coke Company, had devised an arrangement for facilitating the charging of inclined retorts, which his Directors had decided to apply to 16 settings at Beckton. The machinery has been made by Mr. J. Ruscoe, of Hyde, near Manchester, who will be pleased to show it to any gas engineer who will make an appointment with him for the purpose. A trial took place last Tuesday in the presence of Mr. R. Young, Superintendent of the Allegheny (Penn.) Gas-Works, Mr. J. Young, Manager of the Hanley station of the British Gaslight Company, and Mr. Marshall, of Hyde.

WATER AND SANITARY AFFAIRS.

MR. CAUSTON'S Bill (the second reading of which is put down in the "Orders of the Day" for Thursday next—though there is, of course, no likelihood of it being reached at that time) has made its appearance, entitled the "Water Companies' Charges Bill," backed by a dozen Metropolitan members of Parliament. It provides in the first clause that the water-rate in respect of any tenement within the Metropolis, shall not be increased except on one or other of the following grounds: That there is a larger use of water in connection with the tenement; that the cost to the Company of supplying water to it has increased; or that the person on whom the demand is made has, for good consideration, entered into a written contract to pay the increased amount. On this, we may observe that in many cases the Company would be entitled to increase the amount of the water-rate for one or the other of the first two reasons, or even for both. When a house is pulled down in London, it is generally rebuilt with an increased number of storeys; and there is a great extension of the system of letting out in "flats." These changes necessarily alter the conditions of the water supply; and would certainly justify increased charges under the law proposed by Mr. Causton. But the augmented value of the property is generally a very fair test of what is requisite to rectify the charge for water; and on this footing, the law might be allowed to remain as it is. There is, however, an idea in existence that the London Water Companies reap an enormous "unearned increment" in consequence of the quinquennial valuation. If Mr. Causton's Bill were placed on the statute book, this illusion might be dispelled. But at the same time a great injustice would be inflicted on the Water Companies themselves. The Bill proposes that if the person liable to pay the water-rate shall, on receipt of an increased demand, pay the Company at the same rate as before, the Company shall only recover the extra sum by means of a judgment in the County Court. We shall be tolerably correct in asserting that everybody who receives a demand for an increased rate of payment, will, if the Bill becomes law, do as permitted by the fourth clause—namely, "decline or neglect to pay the "said proposed increase." Let us imagine the multitude of such instances that would occur almost simultaneously in the Metropolis. We should like to know how the machinery of the County Courts would bear the strain, or with what reason the Companies could be expected to set forth all the particulars on which the respective charges were based. Whatever may be the intention of Mr. Causton's Bill, the effect would be to embarrass and annoy the Companies, by placing them under a system which would render the recovery of their rights, even as allowed by the proposed Act, almost as costly as an absolute surrender. In other words, what the Bill professes to give, would cost the Companies almost as much as it was worth. The Bill also comes under the condemnation of proposing to abrogate rights already conferred by Act of Parliament. If statutory rights are thus to be granted at one time and swept away at another, there is no security for anything. The Water Companies may be the victims to-day, but other parties may suffer to-morrow. In this instance, we see an attempt to upset that which only a few sessions back was granted in compliance with a popular demand. It was insisted upon that the water-rates in the Metropolis should be levied on the basis of rateable value. Parliament passed a law to that effect just five years ago; and now it is asked to undo its own work. Rateable value is to give place to a complicated scheme, calculated to afford no greater contentment to the payer of water-rates, although seriously threatening the rights of the Water Companies. But we cannot suppose that the Government will favour such a design, or that Parliament will stoop to endorse it.

The credulity of the public is being severely practised upon by some of the opponents and critics of the Metropolitan Water Companies. Mr. Jabez Hogg, Member of the Royal College of Surgeons, has appeared as a witness before the Corporation Committee presided over by Sir Guyer Hunter, and has relieved his conscience by declaring that, in his opinion, the water supply of London is "very improper and inadequate." On what grounds this statement is made, we are at a loss to understand. Mr. Jabez Hogg told the Committee "it was found that

"where the water supply was improved, there was a "falling off in the death-rate." Judged by such a standard, what is to be inferred with respect to the water supply of London? During the last ten years, there has been a remarkable decrease in the Metropolitan death-rate; and London is celebrated as a healthy city. One very singular statement made by Mr. Jabez Hogg is that the charge for water in Manchester or Birmingham, for a house rented at £40, would be £1 per annum, as against £3 in London. Putting the rateable value of a £40 house at £33, and the charge for water at 4 per cent. on the rateable value—the scale prescribed by the Act of the New River Company—the annual charge for water would be less than half the amount stated by this scientific witness. If extras are to be introduced to make up the alleged amount, the premises must be very peculiar in their character to raise the charge to £3, and the case cannot be at all an average specimen. Holders of £40 houses in London may certainly inform Mr. Jabez Hogg, from their own experience, that he has made a considerable mistake. Another extraordinary witness before Sir Guyer Hunter is Mr. Deputy Walter. This distinguished number of the Corporation stated that the water supplied by the New River Company to his premises in the vicinity of Fleet Street "was stored in a tank holding 150 "gallons; and they were never able to use it until the water "had been allowed to settle down." If this be so, Mr. Walter's tank must be sadly in want of "cleaning out." The statement which he has made, doubtless in all good faith, is so utterly outrageous, that it ought never to have been entertained. We hope the Committee really had sense enough to know that no water supplied by a London Company is of such a nature that it requires time to "settle down" before it becomes clear and palatable. The monthly reports of Dr. Frankland, Mr. Crookes, and others, entirely dispose of such a notion as muddy water being delivered from the service-pipes in the Metropolis, unless it occurs on some rare occasions owing to a local accident. Another example of a wonderful story concerning a London Water Company appears in the shape of a letter from Mr. Edward A. Arnold, of Kensington, addressed to the *Pall Mall Gazette*. This gentleman having allowed his account with the West Middlesex Company to remain unpaid after the termination of the period to which it referred, is astonished to find that the Company refuse to supply him any longer unless he promptly pays up. Mr. Arnold has enjoyed three months' credit, or more likely six months, and apparently thinks the Water Company must wait still further until he finds it agreeable to discharge his liability. The Company, on the contrary, think they have waited long enough; and Mr. Arnold declares himself "horrified" at their precipitate conduct. Mr. Archibald E. Dobbs has improved the occasion by writing a letter to the *Pall Mall Gazette*, telling the irate Mr. Arnold that he "does not "know the powers conferred by Parliament on the Water "Companies." We cannot see what undue powers are exercised in this instance. Mr. Arnold has simply to pay what he actually owes; and he has to do the same by his butcher and baker. No doubt he is, as he says, "a solvent "citizen, who pays his way regularly." Accordingly, we hope he has by this time treated the West Middlesex Company as he does his tradespeople, and has brought the affair to a happy termination. But we would ask what good purpose is served by random and one-sided statements, calculated to excite a prejudice against the Water Companies, when the latter are doing their duty to the public, and simply seeking their legal rights.

Death of Sir E. Chadwick.—Early last Saturday morning, a long life, a large portion of which was devoted to the promotion of sanitary improvement, was brought to a close by the death, at the advanced age of ninety, of Sir Edwin Chadwick. In his early years Sir Edwin was engaged in literary pursuits; but he subsequently studied for, and was in due course called to, the Bar. His first prominent connection with sanitary affairs took place in 1832, when he accepted an appointment in the Poor Law Commission nominated by Lord Grey. Two years later he was made paid Secretary to the newly-formed Poor Law Board. This Board was dissolved in 1846, from which year onwards he gave his attention wholly to sanitation. In 1848 he was nominated one of the Permanent Commissioners of the original Board of Health; and when this was dissolved he withdrew from public life on a pension. In 1848 he was made a Companion of the Bath; his promotion to the rank of K.C.B. taking place last year when he received the honour of knighthood.

THE GAS INSTITUTE.

PROCEEDINGS AT THE TWENTY-SEVENTH ANNUAL MEETING,

HELD IN THE

TOWN HALL, RYDE (I.W.), JUNE 17 TO 19, 1890.

GEORGE GARNETT, Esq., M. Inst. C.E., President.

PAPERS AND DISCUSSIONS.

We complete to-day the publication of the papers read at the above meeting, with the discussions thereon.

At the close of the discussion on Mr. Travers's paper on "The Extension of Gas Companies' Responsibility to Fittings beyond the Meter," given last week,

Mr. VAN VESTRAUT (London) read a paper descriptive of

AN AUTOMATIC PROCESS FOR CHARGING AND DISCHARGING GAS-RETORTS BY GRAVITATION.

The work of charging and drawing a retort has always been a toilsome and arduous operation. The physical power of a man is put to a severe strain, on account of the exposure to the heat radiated from the hot retort; and the dusty, heated atmosphere of the retort-house and its surroundings are quite inimical to comfortable working. It is true that the operation of charging and discharging gas-retorts is not so trying as the work of a stoker in the stoke-hole of a steamer, where (in the tropics) a temperature of 130° is common, and men frequently faint, and are carried up on deck to recover; and it may not be so bad as the work done by puddlers. Still it is heavy; and therefore it is advisable to adopt any feasible plan of lightening and facilitating this portion of gas work. With this intention, inventions have followed each other from the earliest days of the gas industry down to the present time, with varying success and failure; the principal causes of the latter being that, through the retort being filled with coal, expansion into coke during carbonization jammed the retort at some point, and obstructed the gas-way, or put pressure on the retort and split it.

Machines without end (with chains, ropes, water, air, and steam as motive power) have been tried, and used with some advantages, and also with some disadvantages. The most serious objection to machinery has been this: With a retort as at first constructed, one has a parallel tube of a certain diameter which requires a portion only of its lower area to be filled with coal, and to be filled in such a proportion that, in order to obtain the best results, the charge must be thoroughly coked in the required time. The space above the coal must be reduced as much as possible, so as to cause the gas to pass out of the retort as quickly as it is formed, so that it may not remain in contact with the heated surfaces, which would further break up the illuminating constituents into light hydrocarbons, and deposit the carbon (the light-giver) on the walls of the retort in the shape of scurf. This destructive process commences immediately the gas is formed above the coal; reduction of the olefines and richer gases into carbon and marsh gas being very rapid and certain. Hence it is to the manufacturer's advantage to have his retort so nearly full that the stoker may just be able to pass his rake over to draw the coke. Were the retort to remain uniform in internal diameter, as constructed, machine charging would be of great advantage; but with the first deposit of carbon or scurf, and with the first warping of the retort from the heating of the setting, the original parallelism is destroyed, and a rigid and unyielding scoop cannot be introduced into an unevenly-shaped retort without binding and jamming. The only modes of avoiding the difficulty are to reduce the size of the machine scoops or carriers, or their equivalent, or to have a bigger retort, so as to leave ample margin for the action of the machine within it. A space is, however, thus left above the surface of the coal, in which decomposition of the richer gases takes place, which reduction in light has to be made up by the addition of cannel coal, or compensated for by a lower heat, and less production per ton.

Those machines by which the charge of coal is fed gradually and automatically into the retort have failed through the exposure of the iron screws, plungers, carriers, &c., to the heat of the retort, and on account of the serious internal wear and tear to the retort. In fact, this objection holds against all mechanical motion inside a hot

retort. Still, great advantages have resulted from these attempts at reducing the toilsome labour of the stoker; and these systems are mentioned here to show that it has been a *desideratum* since the beginning of gas making to reduce the labour and wear and tear of the man on the stage. How the problem has now been solved, and in how much more simple a manner than was looked for, is now to be described. M. André Coze, a gas engineer, of Rheims, having directed his attention to this question, considered that there should be some method of making the retorts self charging and discharging by gravitation alone; and the outcome of his trials has been the process which is now placed before you.

To begin with, it may be said that the process is so simple that there is really very little to explain. When one states that the coals tumble into the retort and the coke tumbles out, the whole process is practically described. Many of the engineers now present have seen the process, and the modified and simplified form thereof used at Southall since Oct. 2, 1889; and I appeal to them whether their impression was not similar to my own when I first saw André Coze's plan at Rheims—namely, that it was absurdly simple; in fact, the surprise is that no one had thought of it before. We have been so wedded to our old notions—so accustomed to think that a gas retort, in order to be a gas retort, must be horizontal—that we were inclined to think that previous schemers who tried inclined and vertical retorts failed because they departed from the accepted rule. Although we admired their energy in trying, we secretly considered that the horizontal was the best form; for were not good results obtained from it—10,000 cubic feet of 16-candle gas from a ton of coal; 11 to 15 per cent. of fuel; settings that ran regularly for 1000 days, making an average of nearly 7000 cubic feet of gas per mouthpiece with 21 in. by 13 in. ⏀'s, or say 7,000,000 cubic feet production per retort? What results could be better than these? But we forgot the stage toiler. We have grown so accustomed to seeing him doing his work as he was trained to do it—covered with soot and dust, and perspiring at every pore—that we have regarded his part of the work as an unavoidable necessity of the case. André Coze shows us that we have been mistaken—that, by placing the retorts at an angle of about 30° with the horizon, we have an angle of the retort-floor which is practically suited for all kinds of coal. Mind, I say practically, because theoretically for every change of coal a change of angle is required at which to place the retort, in order to cause the coal to flow. But, practically, from 27° to 32° covers the critical angle at which coals will just rest, and with the slightest downward impulse will begin to flow in an even stream as certainly as water flows downhill. Dust, lumps, dry nuts, cannel, and mixed, all follow the same law. They rest on the bottom when stopped; they flow downwards when pushed down.

Now to describe the means by which André Coze availed himself of this law for practical working.* His setting is different in many respects from ours. It is higher at the back; the arch is carried up in steps; and the back of his retort becomes the inlet end for the coal. Taking one retort, the mouthpiece end is flattened from the ⏀ shape to a square with rounded corners, 22¾ in. by 13¾ in., with a projecting lip or boss at the bottom, about 5 inches deep, to hold the mouthpiece bolts. Above that it is ⏀ shaped; its size being 24¾ in. by 13¾ in. internally for the whole distance where exposed to the heat of the setting. Where it rises and enters the back wall of the setting, the retort is reduced in size to a flat ⏀ of 11¾ in. by 2¾ in., and enters a cast-iron socket of an elbow shoot, agreeing in shape, and flush with, the retort inside. This is turned into a vertical flattened oval shoot, also of cast iron, fitted with spigot and socket joints, and rising to a faced flattened oval mouthpiece on the top of the setting, which is closed horizontally. These retorts are placed close together, 18¾ inches vertical centres apart, and resting on each other, 24½ inches horizontal centres apart. They all fit together, or rest in such a manner as just to allow room for the cast-iron charging end, which is of special shape so as to allow the next piece to fit into it. They can be fixed in this order only. No variation can be made in the form, but any number up to nine can be placed in a setting.

* M. Coze's system was described and illustrated in the JOURNAL at the time of its introduction. (See Vol. XLVI., p. 198; Vol. XLVII., p. 25.)

The shoots leading to the sloping retort must be built into the brickwork, and retained at a certain temperature by preventing radiation. About 18 inches of brickwork round the shoots has been found in practice to be most effective for doing this. Should the shoots be allowed to get too cool, the pitch and tarry matters condense in them, and form deposits, which disturb the regular flow of coal, and cause uneven distribution in the retort. The joint of the shoot and retort next the mouthpiece is left as elastic as possible—being merely a sand-joint, which soon takes up with scurf. The brickwork at the back, surrounding the shoot, is of an open character (a rubble brickwork), so as not to bind the cast-iron shoots and prevent their easy movement under expansion, for which movement a flat duckfoot is provided, which rests on a pier at the back of the work. This freedom of movement is an essential, as liability to rupture is thereby lessened. It will be seen that scurfing the retort is the simplest operation possible, as, by partly opening the top mouthpiece and the bottom, the heated retort becomes a chimney, filled with hot carbon, which soon contracts from the inrush of cold air, and is easily removed. The saving of tools is very great, as none are required beyond a slice and an auger, with a chisel and a stop for each mouthpiece.

The top charging mouthpieces are on a level, and in a line along the top of the beds; while parallel to this line of mouthpieces runs a truck, holding three scoops, which tilt over vertically at the discharging end, and thus ensure the coal entering the retort-charging shoot. The truck, being filled from any given point with three charges of 4 cwt. each, is brought over the mouthpieces that are to be charged. The bottom end of the retort being closed, and a stop put in it, so as to keep the coal out of the mouthpiece, the scoop is tilted over—this being easily done, as the scoop is almost balanced—and the whole charge runs into the retort, distributing itself evenly over the bottom. This operation is repeated for every retort requiring to be charged. When the charges are burned off (and it is essential in this system that the charges should be burned off into coke, and therefore gas firing is advisable to ensure the equal heating of the retorts), the lower lids or mouthpieces are opened, and the stop removed. The whole of the coke is seen held by the sides of the retort; and, by the slightest touch of a slice introduced underneath, it is caused to fall on the stage without any punching, breaking, or arduous labour whatever. The whole operation is simplicity itself, the results depending on the heats and the coals used.

The French Society for the Encouragement of National Industry are accustomed to test any new and promising system that may be introduced; and the following figures were given by MM. Châtelier and Bérard, their representatives, as the certified results of their test of a setting of nine retorts (11 ft. 6 in. by 24½ in. by 13½ in.) on André Coze's system at the Rheims Gas-Works:—

Coal distilled	10 tons 12 cwt.
Gas produced	109,482 cubic feet.
Coke used as fuel	3175 lbs. = 13½ p. ct.
Charge per retort	441 lbs.
Coal carbonized per man per day	9525 lbs.

These results have been checked by competent English engineers with English coals (Pelaw Main and Newcastle) sent over to France for the purpose. On these occasions the setting was tried in every practical manner—with damp coal, with heavy and light charges, and under all conditions which appeared likely to arise in practice.

The first to adopt the process in the United Kingdom was Mr. Morris, of the Brentford Gas Company; and Mr. Trewby is also using it at the Kensal Green station of The Gaslight and Coke Company, where Mr. M'Minn is energetically carrying out a large installation. Here the coal will be untouched by hand from the time of unloading to its delivery into the yard as coke. The South Metropolitan Gas Company, and other gas companies who are extending, are availing themselves of this plan, which enables them to be independent of any special or skilled labour. Anyone can work the tilting of the charging-scoops, or effect the drawing of the coke.

With regard to the cost, the construction of the setting is of a more expensive character than our present patterns, and, with the special form of retorts and mouthpieces described would amount to about (say) £45 per mouthpiece. But, considering the control that the engineer has over the make and illuminating power, by shortening the

duration of carbonizing if required, and considering also the lessened demand on the endurance of the men, this increase in cost would be more than counterbalanced. Since the operation of charging takes but 5 seconds, and the drawing only 30 seconds, a charge that is burned off can be replaced in less than a minute by a fresh charge of coal, which will enrich a poor gas, or increase the make so as to cope with a pressing demand. Extension could be thus deferred, and outlay of capital prevented.

The cost of the setting may be an objection; but this is met by the fact that the Company who own this plan are also in possession of the Morris and Van Vestraut systems, which possess all the good points enumerated in the case of the preceding, and with the additional advantages that English retorts and mouthpieces are available, and the fixed cast-iron shoots (which are built in at the back, and run to about half a ton in weight on the average) are replaced by a light, moveable and telescopic shoot, running on rails in front of the highest end of the retorts.* The shoot is brought into position over the retorts, and the adjustable shoe at the bottom enters into the mouthpiece with the fixed inclinations given thereto, as necessitated by the class of coal used. The ordinary coal-trucks are led over the shoot, and the bottom slide being withdrawn, the coals descend into the retort, as in the Coze plan, and with the same distributing effect. The shoot is then drawn aside, the upper lid closed, and the same operation repeated on the succeeding retorts—one shoot serving for 30 or 40 retorts. The slowing down of the speed of delivery of the coal in the bottom retorts, which is obtained in M. Coze's plan by a double swan-neck elbow, is in this plan ensured by reducing the sweep of the scoop-shoe; the back end of the shoe being depressed by means of an adjusting screw at the back.

In this modified plan, the cost of setting is the same as the ordinary horizontal method; and, taking into consideration the lighter stages, it is actually less. At Southall the charges have to be increased by one-sixth—*i.e.*, a full charge for a 20 by 21 in. by 13 in. ⌂ on the horizontal plan requires to be 6 cwt.; whereas 7 cwt. of coal are needed to fill the sloped retort to the same extent, on account of the retort-floor being packed more evenly than when charged by the scoop or shovel. This fact, and the increase of length on the slope, give each one-sixth more power, or (say) one-third in all to the retort-house in length. As no heavy work is needed in front of the settings, and no coal is required to be stored there, a light stage can be used, half the depth, and half the cost of the present ones. The saving in cost on this item alone will make up for the extra cost of the alteration to the Coze plan; and when a conveyer is used to carry away coke, a double line of settings can be used in the same space as that at present occupied by a single row of settings.

It may be considered by some that this plan of charging by gravitation is only to be adopted by large establishments, on account of the expense of the alteration needed in rasing the roofs of small works to take in the settings, which require to be 22 ft. 8 in. in height with a stage floor, or 14 feet high on a ground floor setting 13 ft. 6 in. deep, clear of buckstaves, for 11 ft. 6in. retorts. Then an additional 6 feet space is required for the tilting-scoop on the top of the bed. Thus a clear height of not less than 20 feet is required below the tie-rod or beam of the roof. When the space is less than this, the roof has to be raised; and in two cases where this has occurred, the cost has been less than 8s. per foot run, or (say) £4 8s. for a setting of seven retorts on the Coze plan, 11 feet from centre to centre of the piers. This expense is covered in a very short time by the increased yield of gas from a given run of retort-house, which is more than equivalent to an equal extension of setting, with foundations, roof, and stage, on the ordinary plan. For instance, the yield for a 10-feet retort of ordinary form can be increased, as stated, one-sixth by the additional length due to the slope of the retort, and an increased power per retort of one-sixth on account of the even distribution of coals by gravitation; or an increase of one-third over the present plan of setting to a given length of house. Taking, for example, an ordinary setting of seven ⌂ retorts, 21 in. by 13 in. by 10 ft. long, yielding (say) 32,000 cubic feet per day, and costing (say) £30 per retort, the change to the present plan will result in obtaining about 43,000 cubic feet from the same length of retort-house, which is equal to an expenditure of nearly £280. Then, as there is no gang or time work needed, as soon as the charges are burned off, the retorts can be drawn. One-fourth more production can be credited to the new plan for this advantage, or (say) £280 + £70 = £350. This is the cost of the Coze patent plan—say, seven retorts at £50 per retort £350. Thus you have all the other advantages at virtually the same cost as the old system, besides the benefit of greater room, cheaper stages, and the facility with which the manager can obtain his labour as it may be required.

In small works, also, the manager is often very pressed for time at some part of the day. With this plan he can load his hopper by means of a differential block, or similar plan, in his leisure time; and, just before lighting his district, can draw and re-charge, and be ready for full consumption in two or three minutes—thus saving fuel by not requiring an extra furnace to prepare for this demand. I am speaking here of those small places where the manager has all the duties to carry out; and very onerous posts they are—requiring more thought and administration than is usually credited to the one who has the control. In such small works, a setting on this system would greatly lessen the labour, and give increased power, because, with a simple gas-furnace, where the heat can be increased or diminished by means of air-slides, the power to make from only one retort 7000 to 8000 cubic feet of gas in twelve hours, if required, would relieve a manager of many an anxious moment. Taking the other extreme of the scale, there is the case of one retort-house capable of turning out 5 million cubic feet of gas per day under the supervision of four skilled foremen, who can choose their labour supply, and distribute their coals to any required point by conveyers, and discharge the issuing coke by the same means into the yard; so that no handling of the coal actually occurs in this case from the unloading of the barge to the coke-yard, unless by an accident.

The system is of such simplicity, that one's first idea is disappointment that so many valuable years should have been lost in elaborating complicated methods. Now that the plan has been further simplified by the Morris and Van Vestraut inventions, so as to utilize English retort mouthpieces and patterns, it is ready for the use of any engineer who intends to increase his producing power at a less cost than on the old systems; and it will amply repay any little initial trouble in its adoption, by the increased power it gives him over his light. On this point may I mention that in small works, where no sale exists for it, the tar can be economically used up by running it into the upper end of the retort after the third hour of carbonizing, and when the charge is getting hot enough to vaporize the tar. In this way it can be used to enrich a poor coal. The men employed can also be made more comfortable while drawing the coke, by using a slotted moveable screen to shield them from radiation. When the travelling conveyor is used to take away the coke as it falls from the retort, it can be carried under a spray of water, over screens, and out into the yard or into trucks as required. The whole operation thus becomes almost automatic, and reduces the cost of gas making by from 2d. to 3d. per 1000 cubic feet, according to circumstances; thus enabling the gas industry to take another firm step in advance towards cheapness and favour—synonymous terms. In coal we possess the cheapest carbonaceous substance known; and if we deal with it wisely and carefully, we need not fear the competition of other illuminants.

Discussion.

Mr. W. T. Carpenter (Sheerness) said that the scheme submitted to the meeting was quite familiar to him, as he had had a great deal of experience with inclined retorts; and the arrangement shown was very similar to one with which he had experimented. He tried the retorts at all angles, from 20° to 40°, and found that 30° was the best angle of repose. But even with the most careful charging—putting the coal in gradually with scoop shoots and pipes, very similar to those described in the paper—they would sometimes become blocked. The bottom end would ultimately get full, and thus would wear out the side; and he had to have retorts charged from the top in the ordinary way, and the coal raked up level. Even then he should have been only too glad had he succeeded; but a vast quantity of tar found its way to the bottom part of the

* The improvements on the Coze arrangement devised by Messrs. Morris and Van Vestraut were described and illustrated in the Journal for Feb. 25 last (p. 339).

retort, and caused great inconvenience. When a man went to slack off the lid, as much as two or three pints of tar would come out, according to the charge of coal. These were the obstacles in the way of adopting the principle which led him to improve the inclined system. This he did by making the continuous apparatus on which he read a paper before the British Association of Gas Managers in 1878; and he experimented with it for ten years. One more point he ought to mention—that in taking the gas from the bottom there was a loss in quantity. Hot gas could not be induced to go downhill very nicely; and therefore he was compelled to put the outlet at the top. In taking the gas out at the bottom, the top end became much choked with carbon.

Mr. JOHN WEST (Manchester) said the reader of the paper claimed that he did considerably more work by his method than by any other; but he (Mr. West) wished to say that the work the author claimed to have done was now being accomplished in several works by his (Mr. West's) machinery, and the charges at Ramsgate were larger. As had been seen at Beckton, they were filling the retort with coal so full that they could hardly get a rake over it; and he did not think they could go any further than this. He did not see how the engineer could control the illuminating power or shorten the duration of the charge by the system described more than by any other. At Manchester they obtained by his small hand machine from 8000 to 8500 cubic feet of gas per mouthpiece for two months continuously.

Mr. J. MILES (Bolton) said he should like to ask, with regard to this system, if the deposition of the coal in the retort could be entrusted to an unskilled person; because, if that unskilled person were careless, it seemed to him, as Mr. Carpenter had pointed out, that he could very easily block up the retort. This was one of the difficulties to be encountered; and he should like to know if it had taken place in actual practice. Then it had occurred to him that there must be a very large deposition of tar at the mouthpiece, where the coke had to be extracted, when the lid was taken off; and this must be dangerous to the man who had to perform the operation. It might burst out into flame, and produce other discomforts which one could hardly think of at the moment.

Mr. T. H. MARTIN (Barnet) said the results stated in the paper were to his mind very astonishing indeed. It appeared that the make per mouthpiece was from 7000 to 8000 cubic feet per twelve hours. He gathered that the make per mouthpiece wou'd be taken in the ordinary way per 24 hours—7000 to 8000 cubic feet; and if there was an increase to this extent, they were certainly making rapid strides in carbonizing. He presumed that the coal could be taken from the trucks, and did not require to be touched until it came out carbonized; but it occurred to him that in winter time it would not be possible to unload the coal in this way, and have no storeage. Therefore, could the author give the cost of lifting the coal into the hoppers. He had mentioned small works, where he said one man could do certain things. But very few managers had time to do them between the charges; and he should like to know what it would cost, if there was not a coal-store, to erect stores where they might be necessary. Where there was a railway running above the works, a coal-store might be formed without difficulty; but in other places the coal would have to be lifted on the same principle as was shown by Mr. West, on the continuous process—much like corn. He also wished to know whether it would be necessary to break the coal used in this system; and if breaking were necessary, what would be the additional cost.

Mr. MILES said he had forgotten to mention one important point. The author said the inclination would have to be varied according to the kind or quality of the coal used. Now, in large works it was impossible to confine oneself to a particular kind of coal. The contracts were made with half-a-dozen contractors, and the coal came from several pits; each coal having some particular quality. Where a large quantity of cannel was used, it was of a different character from the generality of coal; and a retort of the kind which might be applicable for coal, would not be at all suitable for cannel.

Mr. T. O. PATERSON (Birkenhead) said he had seen the process at work in France, and had examined the charges; and he must say they were laid very evenly indeed throughout the retort. If anything, they were rather thicker at the top part than at the bottom. The coal was ordinary Yorkshire, taken from the stores without going through a breaker, or being treated in any special way. The retorts were charged at the top, and the mouthpiece was open at the bottom, which caused a draught right through. Looking up, the coal could be seen lying perfectly level throughout the retort. He was very pleased with the system; so much so that at Birkenhead they had decided to put in four settings, and give it a thorough trial. They had to raise the retort-house roof 10 feet—it being an old ground-floor house, and they wanted to make it into a stage. It would be 30 feet high to the eaves. He believed it would be necessary, where coal and cannel were used, to have a coal-breaker, otherwise blocks would come in that would cause a stoppage. When in France, he noticed that the coke was perfectly free from tar, and quite dry. He had also visited the works at Southall; and there, too, it was quite free from tar.

Mr. VAN VESTRAUT, in reply, said he was pleased to have heard Mr. Carpenter speak on this subject, and was very sorry that gentleman had not continued his experiments, because he thought success was before him when he took out his patent. Even then it succeeded wonderfully well, and only required a little alteration; and he might have had the credit M. Coze claimed at the present time. He was not the first, however, as attempts in this direction were made, as he had stated, by Clegg in 1804, and in 1806 by Accum. The difficulty was that they filled the retort too full. As Mr. Carpenter had mentioned, in throwing the coal down in a lump, if the bottom of the retort were filled, the coal was apt to expand and destroy it; but if it was delivered at a certain speed, so that each successive portion of coal would just push the other down the sloping retort, there was not this binding up. He was sorry there were no means of demonstrating this; but it was as simple an experiment as possible. If they took a board, and placed it at an angle of about 30°, it would be found that the successive accretions of coal falling upon it at the back part simply pushed the others forward, and did not jump over them unless too great a speed was employed. With regard to gas going downhill, the difference in height between the bottom of the retort and the top would be about 5 feet, which would give a pressure of about half-a-tenth.

Mr. CARPENTER said there was a material difference between hot gas and cold.

Mr. VAN VESTRAUT said the pressure was the same. At Southall, there was no objection on this head. The general pressure in the retort there was 2-10ths or 3-10ths, which avoided the possibility of drawing the furnace gas through, and gave an ample margin to cover the increase of half-a-tenth in the retort. Then being open at the top end, the retorts were not like the pattern which Mr. Carpenter had in his mind. The top end did not block. Should it do so, it was a very simple thing to open the top of the mouthpiece, clear with a chisel, and the dirt would go below. But this difficulty had not been found at Suresnes or at Rheims, where it had now been at work for three years. In reply to Mr. West, he would say that what they claimed was filling the retort by gravitation, without machinery or any skilled labour—dropping the coal in, and allowing the coke to fall out. With reference to broken coal, of course it was impossible to put in a retort a piece of cannel 3 feet thick; and any large piece of coal must be broken up. Good results could be obtained with ordinary coal; but if it were all reduced to small size, it would be going back to Clegg's old idea of a revolving furnace, where the coal was broken into nuts, and passed out as coke at the other end. This could not be done yet; and so the better way would be to break the coal into small pieces of fair average size—say, 3 or 4 inches. With regard to working off the charges, the gain lay in the fact that the manager was not dealing with an ordinary gang of workmen. At Southall there was a setting of 14 retorts—seven throughs, 10 feet long—and two men would draw a charge in 20 minutes; but it might be put down at half an hour. Then if the same thing was done every hour, three men would be doing $8 \times 14 = 112$ retorts, as against 72 by an ordinary gang working in London—a very distinct gain. It was easy work, too. The man at the top had simply to fix the shoot into the retort, hold it while the coal fell; and the same at the bottom end. Mr. West also referred to the control of the illuminating power of the gas. This was what every inventor if it were simply of a new rake-handle, claimed. If the charges could be shortened by the facility of charging, of course this was an advantage.

The duration of the charge was simply a question of heat; and thus had nothing to do with the system nor the amount of charges. He did not see why they should not have their retorts much wider; and he believed the time would come when they would put a truck load of coal into a retort at one time. Mr. Miles had brought forward the difficulty of the deposit of coal by an unskilled workman; but there was no trouble whatever in regard to the delivery of the coal. It was simply loaded from the truck into the hopper; the man at the stage had no control. There was an objection to this system, that there was the possibility of a deposit of the tar at the bottom of the mouthpiece. This tar, being there, kept the ascension-pipe cool and soft; and there was always a distillation of the lighter oil going up the ascension-pipe, tending to keep it clear. Of course it did not cure a stopped pipe. Still there was the disadvantage that a certain amount of tar ran down. At Southall, however, nothing objectionable occurred. He might point out that, on account of the sloping shape of the bottom retort, when the man was drawing it, the top of the mouthpiece formed a shield, and he was not so much exposed to the heat. He had himself drawn the retorts, and could say that the heat was not very excessive. At Southall they were using four or five different classes of coal. The make of gas per mouthpiece depended on the size of the retort.

Mr. W. Gadd (Manchester) next read a paper on

THE PRINCIPLES INVOLVED IN THE CONSTRUCTION OF THE NORTHWICH GASHOLDER.

In consenting to read a paper before The Gas Institute on "The Principles Involved in the Construction of the Gasholder at Northwich," I trust I may not be considered presumptuous, or as going too far, in assuming that these principles have been, and are even yet, from want of opportunity for investigation, very partially apprehended by a considerable number of engineers and others. Further, I feel emboldened to express the opinion that much of the published literature, which has appeared in the various gas publications, shows that there cannot have been a very clear idea of the principles involved in an *ordinarily* guided gasholder, to say nothing of the innovation, more especially under present consideration. For example, we find the following somewhat remarkable statement: "It is impossible to construct a framework strong enough to uphold a gasholder of any considerable size without depending upon the inherent stability of the holder itself." And then quite logically continued: "There is, in the construction of gasholders, a point, depending entirely upon their bulk, beyond which these structures are wholly independent of the external framing." In other words, as it appears to me, if one only makes one's holder big enough —although it *is* a floating vessel—it will resist the wind pressure without any support other than floatation.

Now, I have to confess that I cannot anywhere find this inherent stability of a floating inverted bell, which has only a few inches of immersion in water, and a centre of gravity very high; indeed, my investigations have been carried on, and inventions made, under the most profound conviction that no inherent or other stability exists in such a structure, however large or however small it may be. On the contrary, I find the conditions are undoubtedly those of constant instability, at whatever size the bell is constructed. This, I think, will readily be conceded by anyone who has a scientific conception of the forces that are generated in such a mechanical contrivance as a floating gasholder.

It is, nevertheless, perfectly true that there are degrees of instability in gasholders of the ordinary type when afloat, chiefly due to the proportions of their height to their base, together with the positions of their centres of gravity; that is to say, some holders have a greater amount of instability than others. This presented itself so forcibly to competent engineers, that it was at once conceded that "if some *practical* means could be devised whereby all the bottom rollers might be made to rise and fall equally, the holder would then, to all intents and purposes, have a solid foundation, and no columns or guide-framing of any kind would be necessary." Then followed the statement, which was perfectly true at the time, that there were no known means for keeping the bottom rollers in the same plane; and thus guide-framing to a considerable extent was requisite, and it was doubted whether anyone would attempt to go beyond this. Well, gentlemen, as you all now know, I did attempt to go beyond this; and I am sure you are pleased to have learnt that the success of this attempt has been completely demonstrated in the holder now working so successfully at Northwich.

As some of those interested appeared to so imperfectly understand the principles involved in ordinary holders, it is not surprising that they went astray, to a great extent, with regard to the new departure. For instance, we find one writer saying, in relation to my proposal, that "it must be ascertained also that the holder would not have any tendency to screw itself out of the guide-channels." It is not clear, however, what this means, or where the holder could obtain such tendency. True, he supplements the words, "but this it could scarcely do," which only adds, apparently, to the confusion of thought. The impression has also gained ground that an extraordinarily strong bottom curb is essential to my system of guiding, and that very much strength must be added to the upright members of the inner and outer lifts. On these matters I propose to enlarge somewhat on the present occasion.

It has been further suggested that the wind force will tend to turn the holder either one way or the other, and thus reduce (or increase, as the case may be) the internal pressure of the gas. In the light of demonstrated fact, all these fanciful theories utterly disappear. I do not doubt that other theories have been entertained of a more reasonable nature, involving, in the minds of some whose knowledge is entitled to respect, possible changes in construction when much larger holders are dealt with. To these I have only to say that slight changes of form, to suit the altered conditions, are not necessarily increase of weight, and indeed may be, in some details, even the contrary. This I feel sure you will accept as true when you have had sufficient opportunity of well considering the few words I have to say.

In some of the diagrams before you, you have the details of the Northwich holder; * while in the other diagrams you have certain ordinary mechanical principles simply portrayed, to which I shall presently refer.

I will ask you to consider with me the tank in which the holder rises and falls, and to realize that here is the base or final circle of resistance to all the strains which are generated in the structure. Now, it is clear that a well-built tank wall is a far more rigid circle than any bottom or other curb of a gasholder which has ever been constructed, or dreamed of by gas engineers. Hence we have a base of extraordinary rigidity.

The details of the holder show that the rollers are tangentially mounted, and, in this example, are grooved. The result is that the rollers cannot be either pushed or drawn away from the rails on which they run, beyond the slight amount of lateral play or freedom allowed. Hence, as the rails are firmly secured to the tank wall, this latter really forms a final rigid bottom curb, reducing the bottom curb of the holder to a means of secure attachment for the roller carriages, and reserve of resistance. We thus see that, in practice, a very flexibly-constructed bottom curb for the holder can be held exceedingly rigid in the guide-rails, when grooved tangential rollers are employed to guide the same in their working positions.

Now we come to the outer lift, around which, on the inside face, are fixed the spiral rails for the inner-lift rollers to travel upon. These rails form diagonal struts or bracings for the framework of the outer lift, and connect the top and bottom curbs very securely together; thus giving an enormous increase to the strength of the ribs and rings of the outer lift over that of the ordinary kind. The form of these rail bracings, being also arched or bow-shaped, adds a degree of strength in excess of the mere sectional measurement of the same. These diagonal arches form a tremendous resistance to local distortion of the sheeting of the outer cylinder, which no holder constructed upon the old lines of guidance is likely to possess.

When the inner lift is fully inflated, and completely cupped with the outer cylinder, the whole of the strain of lifting, or the lateral strain from wind pressure, need not come upon the cup rings, as is the case with the ordinary holder; and herein lies the answer to one difficulty which, I believe, has arisen in the mind of at least one engineer on this subject. He is, I understand, doubtful, in the case of a large holder—say of 150 to 200 feet diameter—whether the present strength of cup rings and dip of sheeting would be sufficient.

* These diagrams were given in the Journal for Feb. 4 last (p. 194)

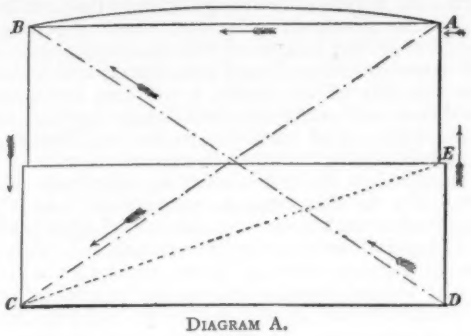


DIAGRAM A.

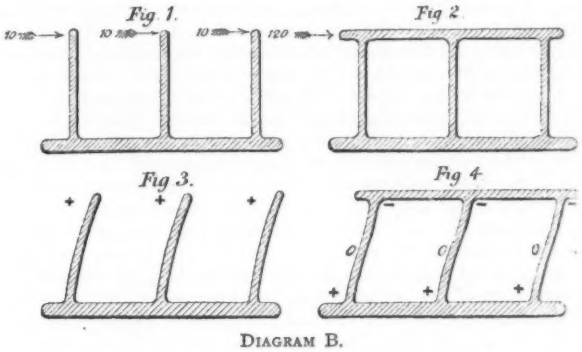


DIAGRAM B.

Of course, it would be no argument against the method of construction if this doubt were well founded; for it would be very easy to strengthen these parts. As matters stand, however, there is no necessity to do this, since the lateral strain from the wind is taken up by the guide-rails and framing; and there is really no need for the edge of the cup of the inner lift to come into actual contact with the top ring of the outer cylinder, if it is desired to transmit the strains to the tank side without putting the cup sheets in circuit therewith. We can short-circuit the strains, so to speak, cutting the cup sheets out, by providing suitable stops on the top of the guide-rails, so as to lift direct at the framing. These are not provided in the example under consideration—they being utterly unnecessary; but such course can readily be adopted with a very large holder, if thought desirable. Personally, I do not at present think it requisite, as, in any case, the lateral strain is resisted by the inner tangential rollers pressing on the guide-rails, without the necessity of depending on the frictional lateral resistance of the cup rings at all. The inner lift is guided during its rise and fall by means of the rollers on its bottom curb, which work into the spiral guides affixed to the outer cylinder, and forming part thereof. When the whole structure is fully elevated and inflated, it is held all round the bottom curb of the outer lift by the rails attached to the tank wall; and, considered as a whole, it forms a single cantilever, whose base is greater than its height. Roughly, the height is two-thirds the base.

Now, in such a mechanical system we may first consider this cantilever as a rigid structure, and then as to how and where the practical construction deviates from that condition when it is subjected to strains induced by wind pressure. Viewed as a rigid structure, it will be clear that there would be developed two triangles of forces, as shown on the Diagram A, when such wind force is considered as taking effect through a single plane, cutting out a section of the holder from side to side. The lines of these triangles, A B C and A B D, have arrows indicating the direction of the forces, and the lengths of the lines represent the corelated values thereof.

Now, if we suppose the equivalent of all the wind force to be applied at A, and represented by A B, and resisted at the two points C and D, it is very palpable that the force D A will always equal the force B C, and the force A C will equal that of D B; because the line A D, forming the side of one triangle, equals the line B C, forming the side of the other, and the line A B is common to both triangles. Hence, the resulting lifting force of one side will equal the depressing force of the other side. In like manner the force D B will equal A C. Thus the rails round the tank are subjected to two forces on each side; those on the windward side lifting vertically and diagonally, while those on the leeward side are acting in the reverse direction.

To get at the value of these forces, if such a structure is subjected to a gale of 50 lbs. to the square foot, is a comparatively simple process. For brevity's sake, we will take the holder to be elevated, and to measure 60 ft. by 40 ft. uniformly from top to bottom, and consider the whole height as exposed to wind pressure. This is in excess; but the error is on the safe side. Now—

$\frac{60 \times 40}{2} = 1200$ square feet = the equivalent plane area of exposed surface.

$1200 \times 50 = 60{,}000$ lbs. total distributed wind pressure exerted on the holder. This is equivalent to 30,000 lbs. exerted at a point (E) 20 feet high.

Then $\frac{30{,}000 \times 20}{60} = 10{,}000$ lbs. of total vertical force

which, if distributed equally through the points represented by the eight rails $= 10{,}000 \div 8 = 1250$ lbs. = the simple vertical force on each rail acting in contrary directions on opposing sides.

But there are the forces A C and D B to be considered. These do not develop any vertical action upon the structure, because they are equal, and operate in opposing directions, at equal angles, upon the sides A D and B C. They form, in fact, the bending forces tending to the distortion of the various parts of the holder, which tendency we must now take into account, for the structure has to be considered as possessing only comparative rigidity.

A reference to the diagram will show the force B D is tending to push over the side B A; and the force A C is tending to pull over the side A D in the same direction by closing the angle A B C and opening the angle B A D. You will thus see that the top curb, or the angle joint of the sides and crown, has to take up this strain.

Now let us see the value of these distorting diagonal forces.

30,000 lbs. applied at E become equal to 15,000 lbs. applied at A = 60,000 lbs. distributed pressure.

The diagonal forces will each be about $\sqrt{(60^2 + 40^2)} = 72$

Then $\frac{15{,}000 \times 72}{60} = 181{,}000$ = the total bending and distorting force to be resisted by the construction D A B C.

The circumference of the top curb is about 188 feet, or 2256 inches; so that if we distribute these forces around the curb, we get a fraction over 80 lbs. of diagonal force exerted at the vertex on each lineal inch of the angle-iron; such force tending to open the angle on one side of the holder, and close it on the other. This, of course, is so enormously within the margin of strength of a very weak top curb, that it may be dismissed without the slightest compunction.

There remains only the possible buckling of the rafters and crown plate, and the possible buckling of the vertical posts or sides. With regard to the buckling of the roof, I think you will agree that it is a thing which need never be considered in this relation, for two reasons. First, it is the strongest part of the holder for transverse-strain resistance; and, secondly, what is of more immediate importance, it is simply employed (in a hollow cantilever, like the structure portrayed) in transmitting the force from one side to the other, edgewise of the metal.

With regard to the vertical posts, I desire to call attention to the results of a series of experiments I was able to make upon free cantilevers, as compared with a series rigidly connected at the top ends thereof. On Diagram B, we have, in fig. 1, three independent cantilevers, whose breaking strain we will assume as being 10 lbs. each. Therefore, 30 lbs. applied to the three will break the whole. Now, the question arose in my mind whether, if these free cantilevers were rigidly connected at the top into a system, as in fig. 2, there would be any material increase of strength in resisting lateral thrust. I had never seen any reference to such a question in any text-book, so far as I could remember; but I was inclined to think there would be, in the case of rigid connection, an increase of resistance. I had an opportunity of asking the opinion of a writer of considerable repute on gas engineering subjects, and he doubted whether such would be the case, except to a slight extent. And I suppose (I have not examined) that the tables for gasholder construction take no account of any such increase of resistance to thrust resulting from the vertical posts of a holder being rigidly connected to

the top, as gasholders have not previously been treated as cantilevers. To solve the problem, I determined on a set of experiments of many different substances, and also studied the theoretical aspect of the case. From theory, before experimenting, I concluded that the resistance should be doubled at least; and by exhaustive experiments I found this resistance to be increased fourfold. That is to say, whereas if 30 lbs. of thrust will break our three supposed free cantilevers, as in fig. 1, it will require a force of 120 lbs. to break them when connected into a system, as in fig. 2. In like manner it required four times the force to deflect the three connected cantilevers to the same degree as that of the three free ones. The reason why this is so can be readily demonstrated from figs. 3 and 4.

Now, this fact has a very important bearing upon the strength of holders built on my cantilever principle, as compared with those of the ordinary kind, which are subject to direct thrust against the guide-framing surrounding them. But apart from the advantages to be derived from this valuable fact, the arched diagonal rails provide such an enormous addition to the rigidity of the lower lift (where the strength is most needed) that there can be no doubt a more stable holder is provided than in ordinarily guided ones, unless the framing is of unusual strength.

The compass of this paper will scarcely permit of detail calculations being worked out showing the exact margin allowed in the various parts over actual necessity; but most of those here present will be quite capable of doing this for themselves, should they wish, now that the principles involved are laid before them.

It will be observed that at all heights the rollers grip the rails, and thus establish what is practically a rigid conection with the tank sides. This it is that causes me to rely upon and recommend this form of holder in preference to that of my other invention of cantilever holder, where the same is guided by the gearing together of a number of points around the holder, either with toothed wheel gearing, geared screw shafts, or rope or chain gearing. This latter means of guiding by gearing may be useful for small holders or added top lifts; but for complete and large holders it can never, in my opinion, give the same degree of stability and safety as the spirally-guided holder.

Discussion.

Mr. D. Clarke (Ashton-under-Lyne) said the members were much indebted to Mr. Gadd for his paper, which was of great importance. It would, he thought, require a considerable amount of persuasion to induce them to adopt the system described. He had seen the holder at Northwich, and was rather sceptical as to its stability. But he saw it rise and come down a certain distance, and it was as firm as could be wished; and he was very much pleased indeed with it. If Mr. Gadd could only persuade them that holders of larger size could be built with equal stability, he would have done a great deal to forward the interests of the gas profession; for it would have considerably lowered the cost of holders, and the risk of breakages of columns and girders would be much reduced.

The President inquired if Mr. Webber had anything to say on the paper.

Mr. W. H. Y. Webber said it was not his intention to have spoken; but, as he had been invited, he would make a few remarks. He was the more reluctant to speak because, while he wished to give Mr. Gadd all the credit that was due to him for the very clever way in which he had taken up this question, he could not but say—having no patent, and no interest in the matter beyond the President's medal and first premium which he had received for his paper read before the Institute at Glasgow in 1887—that he was rather sorry Mr. Gadd seemed disposed to arrogate almost everything to himself. When he (Mr. Webber) directed the attention of the gas engineering profession to what appeared to him as a possibility of abandoning lofty guide-framing for gasholders, he did so in a perfectly tentative way; leaving it open for other people to come after, and apply the principles then put forward. He had thought of a great many ways of doing it besides the one he had described, which he mentioned simply because it seemed to be the one most easily understood, and the one which would most plainly show the principle to which he wished to draw attention—viz., that the stability of a holder in working depended more upon the fit and strength of the bottom than of the top rollers. He believed he was practically the first to draw attention to this great principle, which was impressed upon him in the course of practical experience in the erection and working of large gasholders; and he had not, up to the date of his paper, found any theoretical explanation in any published work (most of which were by French engineers) of what was to him a self-evident fact, that so long as the bottom rollers were taken care of, the top ones might be left almost to take care of themselves. Up to that time it was always held that the wind pressure on holders was distributed equally over the rollers, top and bottom; but his experience did not bear this out. He went thoroughly into the matter, in consultation with several experienced practical gasholder erectors, and thought he was pretty well on the right track, before he said a word about it to the Institute. He did not wish to deprive Mr. Gadd of any credit he would reap from his application of the principle; but, in justice to The Gas Institute, a little more acknowledgment might have been made by Mr. Gadd of the Institute and its Transactions, which were the medium of putting the principle before the profession. Mr. Gadd had made several quotations—all, he believed, from the Journal of Gas Lighting—and it would have been more convenient, and tended to clearness, if the source had been stated. He had quoted from an article of which, although written anonymously, he (Mr. Webber) did not mind acknowledging the parentage, to the effect that for very large holders "it is impossible to construct a framework without depending on the inherent stability of the holder itself." This was rather a striking statement, he was bound to admit, which had been challenged by Mr. Cripps as well as by Mr. Gadd; and he was sorry Mr. Cripps was not present, because there was no man for whom he had a greater respect as an authority on strains, and he should have liked to hear his opinion of Mr. Gadd's mathematical demonstration, which he could not attempt to go into at the moment. Mr. Gadd made the deduction from that quoted remark that if one only made a holder big enough, although a floating vessel, it would resist wind pressure without any other support than that of floatation. This was not quite what he meant. He referred rather to the weight than to the size of the holder; and he might perhaps explain it by referring to the Logan stone—a rocking stone in Cornwall which, although it weighed a very great deal, could be easily rocked by one person. Now, everyone who had walked across the top of a large holder put up in the old days (when they always used to give them plenty of room, so that they should not jam) would recollect that, on crossing the top of it, the weight of one man would throw it three or four inches out of level. What he meant was, that there was a point in the safe working of a holder depending entirely on the bulk—it might have been better if he had said on the weight. He was not sure, after all, that in the case of a very large heavy gasholder (although it was essentially unstable when full), receiving the full power of the wind against one side, when the weight of the holder was in excess of the wind brought against it, the whole force of the wind went against the guide-framing, whatever that might be, whether lofty or basic; just as it no doubt did in the case of a light holder which the wind would almost blow away.

The President said he had had 43 years' experience as an engineer and manager of gas-works; and he honestly believed Mr. Webber was right. He had seen accidents more than he could find time to recount, at Ventnor, Newport, and Portsmouth, all of which crowded into one's mind, and the moral of which he should say was that, whatever they did, they should never be led away by the doctrine that it was not a right thing to have a good foundation or a good stiff bottom curb.

Mr. Gadd, in reply, thanked Mr. Clarke for his remarks, and said he might add a circumstance which would show the stability of the Northwich holder. It was fully elevated with only 7 inches immersion of the bottom curb in water the whole of one night, so as to be in readiness for an inspection to be made by the members of the Manchester District Institution the next morning. During that night it happened that there was an exceedingly heavy gale—so strong, indeed, that some iron coping on the works was swept clean away; but those who had the opportunity of standing under the holder and against it at the time, declared that there was no vibration of any kind. He thought Mr. Webber was under a misapprehension in supposing

that he, in some way, arrogated to himself the whole of the credit to which that gentleman was entitled. He could only say that he had always been anxious to give every possible credit to Mr. Webber for his work in this matter. He had already stated that it was Mr. Webber's paper at The Gas Institute meeting that first set him thinking about it; and he had said this over and over again. But the title of the paper now before them was "The Principles Involved in the Construction of the Northwich Gasholder." It was a purely mathematical one; and therefore it was not proper to deal with the history and evolution of the matter at all. He had tried to deal with the principles involved, and had only made quotations from existing literature without reference to the writers; and he did not know before that Mr. Webber had fathered the article he spoke of. He only quoted the passage because he thought it contained an erroneous impression. Mathematics were mathematics; and no amount of personal consideration of any kind could dispense with them, or would ever make three angles of the triangle more than two right angles. As engineers, they must act on true principles in construction. He was glad to hear Mr. Webber's explanation of the quotation he had given; but he had previously had no means of knowing the meaning of the words except the words themselves. The rocking-stone illustration did not appear to him to be analogous. That depended on the facts of the position of equilibrium and of the centre of gravity; whereas the centre of gravity in a gasholder was really very high, and the structure was under different conditions to those of the rocking stone. If the guide-framing of an ordinary gasholder were taken away, and the holder left to try to balance itself, with nothing else, the weight all on one side would make it tip over. As Mr. Webber had said, even the weight of a man on the top deflected it. This was because the centre of gravity was so high that the weight could easily affect it; and, in fact, the weight of a man on one side would have turned the holder over if the guide-framing had not been there. A gasholder was very unstable. It might be said to be in the condition of what mathematicians termed "perfect equilibrium"—not the balance of equilibrium, but in perfect equilibrium such as was obtained by standing a walking-stick on one end. As long as the stick was in perfect equilibrium, it would stand; but the moment it was out of equilibrium it would fall, and would never tend to right itself at all. Now, in a system in a balanced equilibrium, like a pair of scales, when one side was turned down, there was a tendency for the scales to right themselves by the balance of equilibrium; but a gasholder was not an analogous case. It was like an iceberg floating in the sea. When the water had worn away the base, it made the centre of gravity get up into the clouds; and when this occurred, suddenly, without a moment's warning, over went the vast mountain of ice. There was plenty of weight there—weight such as no gasholder could ever be compared to—to give stability. Then it found a new balance, with the centre of gravity below. The President was quite right in speaking of the importance of a strong bottom curb. But they were now dealing with a new system; and what he wished to point out was that the bottom curb need not be made any stronger than it was at present.

Mr. Webber said he hoped Mr. Gadd would not think he had the slightest wish to disparage him, or the work he had done.

Mr. E. Lloyd Pease (Darlington) followed with a paper

ON WIRE ROPE IN PLACE OF RIGID FRAMING FOR GASHOLDERS.

Apart from the question of the precise value of wire ropes as a means of obtaining the required stability for gasholders, I trust that a short examination into some of the most effective ways of arranging them when employed for this purpose may not be without interest. I feel it an honour to be given this opportunity of laying the subject before you, and trust that the system may in some degree recommend itself to the expert opinion of this meeting of gas engineers. The disposition and working of the ropes is not, at first sight, very easily distinguished; but I hope to be able, by a short description and the drawings before you, to make the real simplicity of the system perfectly clear.

For the purpose of introducing the subject, perhaps I may be allowed to remark that a gasholder, pure and and simple, without anything to restrain its movements, is a body having such unstable equilibrium, that it is not possible to balance a holder in a tank of water with success, even if it is only a model. Some restraining force is absolutely necessary to prevent it pivoting, first one side and then the other, as it sits upon the water. I must further remark that, when a holder tilts, there are two points in the circumference of the bottom curb, midway between that part of the curb which is falling and that which is rising, which, speaking approximately, are neutral. If the points of movement are suitably connected to the neutral points, all movement is checked. Or, again, if that part of the holder which is rising is suitably connected to that part which is sinking, the tendency to rise is checked by an equal tendency to sink on the far side. This connecting link is the part played by the wire ropes. By their means, together with the necessary training pulleys, any point on the top curb may be brought into connection with a point on the bottom curb a quarter of the circumference distant in such a way that the top curb, in its rise from the level of the tank coping, can draw out just as much rope as, and no more than, is supplied by the rise of that point on the bottom curb to which the rope is also fixed in its rise from the bottom of the tank to the same level. And this point, it must be noticed, being a quarter of the circumference distant, is a neutral point in the case of that part of the top curb to which the rope is fixed tending to tilt up. In order, however, to tilt, more rope must be drawn out than is available, as the point to which it is fixed on the bottom curb, being half-way between the tilting and the sinking side of the holder, is stationary, and therefore the tilting cannot take place in that part of the top curb. The rope need not be carried to the bottom curb until it has been taken under, over, or round to the far side of the holder; in which case the tendency of the part of the top curb to which it is fixed to tilt, is opposed by a corresponding tendency of that part of the bottom curb to which it is fixed to depress—both of which movements require a further supply of rope than is available. It is obvious, then, that if three such ropes are supplied to a holder, no irregular movement can take place at any part of the holder. I should add that all horizontal movement is checked by radial rollers on the tank coping, working in guides on the holder. These guides also serve as vertical stays; and it is to these guides that the ropes are fixed—that part of a holder which is best able to sustain an upward or downward strain.

It has been more than once asked: If wire ropes are used, why not arrange them as guy-ropes at an angle with the sides of the holder? The reply to this seems to be twofold. In the first place, it would be extremely difficult to bring into operation the automatic arrangement of give-and-take between the top and bottom curb ropes; and, secondly (and this is much more important), they would not be so effectively placed as when parallel to the sides of the holder. For when the holder tends to tilt, since the point about which it moves is somewhere very near the level of the bottom curb, that part of the curb which has a tendency to depress, and that part of the top curb which has a tendency to rise, are tending to move vertically. If, then, the bottom and top curbs are restrained by vertical ropes, these ropes could not be placed in a better position to do what is required of them.

[The author then proceeded, by the aid of models and diagrams, to explain the application of his system (which was illustrated and described generally in the Journal on October 8 last year, pp. 687, 699; also on December 10, p. 1113; and again, in its special application to a holder at Haslingden, in the Journal for March 4 last, p. 385) in seven different ways to single-lift holders. In the first, three or four ropes pass over the crown; in the second, there is a connecting rope, or ropes, or bar, on the crown, to which the bottom and top curb ropes are joined; in the third, more than four ropes pass over the crown, in which case it is convenient to place some at a different level to the others; in the fourth, ropes pass over the crown to alternate or more distant points of application, and are either connected to, or are independent of each other. The author stated that any of these, except the third, could be conveniently transposed, so as to make the tank wall the base of operation in place of the crown of the holder; thus bringing the number of methods of application up to seven. According to the second arrangement the ropes are not

carried over the holder and fastened at either end to a bracket on the tank wall, but are all connected to an endless rope carried on the crown of the holder. They are arranged in pairs; a bottom and a top curb rope passing on to the crown over separate pulleys in close proximity, and trained on to the connecting rope—the one to the right hand, and the other to the left. These ropes both start from the tank; but while the bottom curb rope is passed round a pulley on the bottom curb, the top curb rope passes directly over the crown. The third plan is to a large extent an elaboration of the first. The fourth plan is an arrangement for holders of some size, where it is desirable to have a considerable number of points of support. For example, in the case of a holder with eight points, instead of the ropes passing over the crown independently at two levels, they can all go over at one level, and be so trained round pulleys that, while passing the intermediate pulleys, over which the next rope turns on to the crown, the two ropes can be bound together. As this takes place all round the holder, all the ropes are bound together as if joined to a common connecting rope. The fifth plan is much the same as the first, where the ropes, instead of passing over the crown, are trained round the holder; one end of each rope being fastened to the top curb and the other to the bottom curb, at a more or less distant point. The sixth plan is the second transposed; the connecting rope or bar being placed round the holder on the tank edge, and having the top and bottom curb ropes joined to it. Seeing that when the holder is down, there must be as much top curb rope lying along the connecting rope as will be drawn out by the rising of the holder, the author advised that, for the sake of simplicity, there should be no more points of support than the result of the division of the circumference by the height of the holder. If this did not give sufficient points of support for a large three-lift holder, there would, he said, be no difficulty in supplying an additional connecting ring, with its own curb ropes, intermediate between those, and connected to the other ring. The seventh plan is a transposition of the fourth. The separate ropes are trained round the holder, and may connect any points on the top curb with any points on the bottom curb, as distant as may seem desirable; and each rope may be quite independent of any other rope, or they may be joined to each other, all round the holder.]

The thickness of the rope which can be conveniently used depends largely upon the diameter of the pulley round which it will work easily. There is no difficulty in adjusting a 12-inch pulley on the bottom or top curbs, or in the cups of a holder. A $\frac{5}{8}$-inch steel rope will work well on such a pulley, and has a breaking strain of about 12 tons. If, then, such a rope be applied as indicated to a single-lift holder, either passing round the holder to the far side or over the crown, such a holder cannot tilt in that direction until it has overcome the resistance due to the ultimate breaking strain of the rope holding the top curb down on the one side and holding the bottom curb up on the other with equal forces of 12 tons, making a total of 24 tons to overcome. Taking, for example, a holder 50 ft. by 16 ft., the maximum tilting power of wind and snow combined is a little more than 5 tons. Seeing that three $\frac{5}{8}$-inch ropes placed triangularly over the crown prevent the holder tilting in any direction except under a greater pressure than 24 tons, there is a margin of safety which points to the fact that a much large holder would be abundantly safe with the same three ropes. I am indebted to Mr. Cripps's simple formula, in his work "The Guide-Framing of Gasholders," for the extent of the disturbing influences of snow.

Two-Lift Holders.—I will now pass on to the two-lift holder. It will be obvious that, following the lines of the above classification, there are a very large number of ways of applying the wire ropes to a holder with two lifts. Such a classification is more or less arbitrary, as it is merely a question what alteration in detail shall be taken into account; but the foregoing seems to be a happy medium for the purposes of this paper. In dealing with the two-lift holder, it can be taken as one body of two parts, or two bodies working one with the other. In the first case, the holder is supplied with one series of ropes, serving both lifts; and in the second, each lift is supplied with its own series, as if it were a single holder. Without going too much into detail, it may be taken broadly that every one of the seven arrangements will do for either lift, though naturally some more conveniently than others; and perhaps the plan of six ropes over the crown and six round the tank to alternate points (which is being applied to a holder in course of erection at the present time) is as convenient a combination as any, and serves as an example of a holder where each lift has its own series of ropes. The inner lift is regulated by six ropes, making two intersecting triangles on the crown; and the outer by six ropes, which, starting from a bracket on the dip, pass down the side to a pulley on the tank wall, and from there round horizontal pulleys to the next point of support but one, and then down to the bottom curb. Whilst traversing the horizontal space, and when passing the intermediate set of pulleys, each rope is connected with the rope that goes to the bottom curb at that point; thus connecting all the ropes round the holder.

Passing on from a holder in which each lift has its own series of ropes, we come to the two-lift holder with one series for the two lifts. This is, in reality, little but the adaptation of the seven forms already alluded to, with the necessary disposition of pulleys. [The author gave further explanations by the aid of the diagrams exhibited.]

There is a modification of some importance to which I desire to draw your attention in dealing with multiple-lift holders. It will be clearly perceived that, in the arrangements already alluded to, the horizontal traverse of the ropes, or of the connecting bar, must be the same as the vertical rise of the holder. It might not always be easy in a two-lift holder, arranged with a connecting bar or rope, to obtain a horizontal traverse equal to the combined height of the two lifts. To obviate this I have introduced the alternating arrangement, by means of which the rope or connecting bar, if traversing a distance to the right equal to the height of the lift when the inner lift rises, is brought back to its original position as the outer lift rises, instead of continuing in the same direction; and thus it is only necessary to provide a traverse, free from obstacle, equal to the height of one lift in any multiple-lift holder. [This arrangement was explained by the author by means of a diagram.]

With a word or two on the tilting force to be provided against, I must now leave the two-lift holder. The tilting power of snow and wind combined on a two-lift holder of 50 ft. by 15 ft., using Mr. Cripps's formula, is about 8 tons. A $\frac{5}{8}$-inch steel rope, arranged as described, is capable of accounting for 24 tons. I think, therefore, that in using no more than the minimum three ropes, the holder might be considered to be absolutely safe.

Three-Lift Holders.—The great difficulty in discussing a three-lift holder is to determine which of a multitude of designs to adopt as the best. The inner holder may be regulated in any of the seven different ways mentioned; the middle and the outer, each separately in six of them; the inner and middle, or the middle and outer together, in all the ways suitable for a two-lift; and the three-lifts together in any of the seven with the necessary adaptation. When it is remembered that there must be added the fact that the alternating modification, mentioned above, is adaptable in any case where two or more lifts are taken together, the total is quite bewildering.

I am inclined to think that whatever is done with the inner and middle lifts, the outer should be anchored to the tank in as direct a manner as possible. It is when the outer is up, that the full wind pressure is felt; and, dealing with the outer separately from the others, it is easy to make arrangements accordingly. Adopting the arrangement where an endless rope (or perhaps girder) round the tank is used, in the case of a three-lift holder 180 ft. by 30 ft., 16 top and 16 bottom curb-ropes could be well placed round the circumference. In case of a gale of wind, eight of the top curb-ropes would anchor the holder down to the tank on the windward side, while eight of the bottom curb-ropes would hold it up on the opposite side. But in making the calculation, it will be wise to leave out the ropes that are nearest to the neutral point (as inoperative), and take only five top curb-ropes to windward, and five bottom curb-ropes to leeward. The breaking strain of a 1-inch rope is 26 tons; so ten of these give 260 tons of support. The total tilting force of wind and snow on such a holder is, approximately, 62 tons; thus giving a margin of safety of 4 to 1.

I do not propose to discuss the three-lift holder further. It is obvious that it is not the number of lifts in a holder that limits the adaptation, if the thing is sound. A holder with any number of lifts can be arranged for; but having

got into such a maze of combinations in dealing with three lifts, it is well not to wander in greater mazes still.

I have only roughly touched on the detailed arrangement of pulleys and carriages; and I feel, in consequence, that I have not brought the subject before you in a full and satisfactory manner. But no other course seemed to be open to me when, on thinking the matter fully out, there appeared, on the above basis of seven arrangements for a single lift, to be something like twenty-seven designs for a two-lift, and fifty-nine designs for a three-lift holder. It was thus simply impossible to deal with these alternative designs within the limits of a paper; and it is not these details that are of importance at the moment. I am only desirous that there may appear to be sufficient practical utility in the systems as a whole, in the eyes of practical gas engineers, to make the subject worthy of further investigation, when questions of detail will claim attention.

Perhaps, in conclusion, I may be allowed to point to one or two advantageous features in the use of rope. The restraining force operates instantly, and parallel to the irregular movements of the holder. The ropes are attached to the strongest portions of the holder, and cannot set up complicated strains. The ropes and pulleys are easily renewable in a very short space of time, without throwing the holder out of work; there is, however every reason to expect that they will last the life of a holder. The inner lifts of the holders at Manchester and Haslingden are adequate examples of the usefulness of wire ropes in connection with the addition of a new lift to existing holders, since in neither of these cases have the ropes required the slightest attention since they were first put into place. I say nothing about cost, as it is obvious that no engineer will think of adopting the system, whatever the saving, without being first perfectly satisfied as to the soundness of it.

I have in this sketch steered clear of mathematical problems. All questions of strains, I leave to those more competent to deal with them than I am. Where figures are dealt with, I think that an abundant margin of safety has been shown; and, if not, it can easily be increased. One merit of the system is that, knowing the tilting force to be provided against, there is nothing easier than to find the thickness and number of ropes necessary to meet the case.

*** This concluded the reading of papers; those remaining on the *agenda* being, for the want of time, taken as read.

Messrs. John Wright and Co., Limited.—The list of subscriptions of this Company, the formation of which was announced last week, closed last Friday. We learn that the ordinary shares have been largely over applied for.

Resignation of Mr. T. Varley, of Colne.—On the 30th ult., Mr. T. Varley resigned the appointment of Engineer and Manager of the Colne Gas-Works, which he had held for 28 years. He was selected out of 75 candidates, by the Committee of the Colne Gas Company, in 1862, at which time the make of gas was about 7 millions per annum, and the price 5s. 5d. per 1000 cubic feet to small consumers. Extensive alterations in the works and mains were carried out under Mr. Varley's supervision; and by 1877 the make had increased to 26 millions, and the price been reduced to 4s. 2d. In that year the undertaking was acquired by the Local Board, who retained Mr. Varley in his position. Since then the price has been gradually lowered to 3s. 1d., with discounts; and the make last year had increased to 58 millions.

The Automatic Coal-Gas Retort Company, Limited.—Our readers will see, by an advertisement which appears in another part of the JOURNAL to-day, that a Company has been formed, with a capital of £250,000 in £1 shares, to acquire the patent rights for the United Kingdom of M. Coze's system of charging and discharging gas-retorts, with Messrs. Morris and Van Vestraut's improvements thereon, and the rights of the last-named gentlemen in their improvements, for England, Germany, the United States, Switzerland, Italy, Portugal, Spain, and Denmark. The Company will also acquire the rights for a number of other countries, in reference to which patents, or other protection, are being applied for. The patentees' rights are to be acquired for £200,000, £60,000 of which will be payable in fully-paid shares, and the remainder in cash. It is unnecessary here to enter into the merits of the system which the Company will work—this having been done on several occasions in our columns. Moreover, this matter is dealt with in the report by Mr. A. F. Phillips, M. Inst. C.E. (supported by those of Mr. T. Newbigging, M. Inst. C.E., and Mr. H. Woodall, M. Inst. C.E.), which accompanies the prospectus. Negotiations are stated to be pending for the sale of the patents and patent rights in America. The subscription list will open to-day, and close on Thursday next.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 108.)

THE Stock Markets have as yet made little progress towards recovery. All last week the tone was very dull, and business extremely quiet. In view of a possible advance in the value of money, caution is the rule; and there is a disposition to avoid committing oneself too far until the financial outlook is clearer. Gas securities, however, have pursued their own course, and have been both active and firm. Gaslight "A" was especially brisk on Thursday and Friday, and touched 252 more than once—showing a rise of 1. The secured issues, too, though remaining stationary, realized good prices. South Metropolitans were strong; and "B" is quoted 3 higher. A similar advance was made by Commercial old; while the new stock changed hands at nearly top price. So all three Metropolitan Companies have been in good favour. Suburbans and Provincials offer nothing for remark; but among the Foreign undertakings, Europeans have made a fresh start upward, impelled by the bonus of paid-up capital and the last advance in the rate of the next dividend. The rest remain steady, except Buenos Ayres, which has receded ½ in the face of the renewed monetary trouble in Argentina. Water has been moderately active, and is very firm. Chelsea and West Middlesex rose 5 each.

The daily operations were: Quiet business in Gas on Monday; but prices tended upwards. South Metropolitan "B" rose 3; Commercial old, 1; European old, 1½; and ditto new, ½. Nothing was done in Water; but West Middlesex advanced 3. Gas continued quiet on Tuesday, and everything was steady except Buenos Ayres, which fell ½. Water was strong and active. The only feature in Gas on Wednesday was an advance of 1 in Gaslight "A." Water was neglected. Gas was much more active on Thursday, and prices all round were better than the average. In Water, a parcel of Chelsea was "given away" at 261, and rather upset the quotation. Gas was very brisk on Friday, especially Gaslight "A;" and prices were very good. Commercial old rose 2 more. In Water, Chelsea was settled at 265-270, with business at 269—a rise of 5 in the week. West Middlesex was also 2 better. Business in Gas on Saturday was fair. European £7 10s. paid advanced ½ more; and all other issues dealt in were firm.

We append our usual half-yearly comparative tables of prices of the Gas and Water Securities quoted [for the latter, see next page]. With rare exceptions, the degree of variation is slight; and in the cases of some of the rest, the changes are capricious. We therefore refrain from any remarks characterizing the securities generally as a group; but those who have followed our observations week by week will readily read their meaning.

NAME. GAS COMPANIES.	Prices on Dec. 31, 1889.	Prices on June 30, 1890.	Gain or Loss.
Alliance and Dublin Company, 10 per cent. maximum	17—18	17—18	—
Do. 7 per cent.	12¾—13½	12¾—13½	—
Australian (Sydney) 5 per cent. Debentures	110—112	109—111	−1
Bahia, Limited	20—21	19—21	−½
Bombay, Limited	6¾—7	7¼—7¾	+½
Do. New	4¾—5¼	4¾—5¼	—
Brentford, Consolidated	218—223	218—223	—
Do. New	158—163	160—165	+2
Brighton and Hove, Original	41—43	40—42	−1
British	43—45	43—45	—
Bromley, Ordinary 10 per cent.	19—21	18—20	−1
Do. 7 per cent.	13—15	13—14	−½
Buenos Ayres (New), Limited	13—14	13½—14½	+½
Do. 6 per cent. Debenture	107—110	105—108	−2
Cagliari, Limited	25—27	25—27	—
Commercial, Old Stock	242—247	250—255	+8
Do. New do.	195—200	203—208	+8
Do. 4½ per cent. Debenture Stock.	117—122	117—122	—
Continental Union, Limited	47—48	47—49	+½
Do. New 1869 and 1872	32—34	33—35	+1
Do. 7 per cent. Preference	36—38	38—40	+2
Crystal Palace District	200—205	195—205	−2½
European, Limited	22—24	28—30	+6
Do. New	17—18	19—20	+2
Do. do.	11—12	13½—14½	+2½
Gaslight and Coke, A, Ordinary	244—249	247—252	+3
Do. B, 4 per cent. maximum	100—105	100—103	−1
Do. C, D, and E 10 per cent. Preference	248—253	253—258	+5
Do. F, 5 per cent. Preference	125—128	121—125	−2½
Do. G, 7½ per cent. Preference	182—187	180—185	−2
Do. H, 7 per cent. maximum	157—162	163—167	+5½
Do. J, 10 per cent. Preference	247—252	253—258	+6
Do. 4 per cent. Debenture Stock.	112—115	115—120	+4
Do. 4½ per cent. Debenture Stock.	121—125	123—128	+2½
Do. 6 per cent. Debenture Stock.	160—170	163—168	—
Imperial Continental	213—218	218—223	+5
Malta and Mediterranean, Limited	5—5½	5—5½	—
Metropolitan of Melbourne 5 per cent. Debenture Stock	113—115	112—114	−1
Monte Video, Limited	18¾—19¾	20¾—21¾	+2
Oriental, Limited	8¾—9	8¾—9	—
Ottoman, Limited	5⅞—6¼	5¾—6	−¼
Pará, Limited	3¾—4¾	4—5	+½
People's Gas of Chicago, 1st Mtg. Bds.	100—105	98—102	−2½
Do. 2nd do.	95—100	95—100	—
San Paulo, Limited	14½—15½	15—16	+½
South Metropolitan, A Stock	295—305	290—300	−5
Do. B do.	228—233	235—240	+7
Do. C do.	240—250	247—252	+4½
Do. 5 per cent. Deb. Stk.	135—140	140—145	+5
Tottenham and Edmonton, Original	11—13	11—13	—

Name. WATER COMPANIES.	Prices on Dec. 31, 1889.	Prices on June 30, 1890.	Gain or Loss.
Chelsea, Ordinary	260—265	260—265	—
East London, Ordinary	211—215	215—219	+4
Grand Junction	125—130	122—126	−3½
Kent	276—281	275—280	−1
Lambeth, 10 per cent. maximum	251—256	250—255	−1
Do. 7½ per cent. maximum	197—202	197—202	—
Do. 4 per cent. Debenture Stock	120—124	122—126	+2
New River, New Shares	364—369	367—372	+3
Do. 4 per cent. Debenture Stock	127—130	127—130	—
Southwark and Vauxhall, 10 per cent. max.	167—172	170—174	+3½
Do. 7½ per cent. maximum	163—168	158—163	−5
West Middlesex	260—265	263—268	+3

ELECTRIC LIGHTING MEMORANDA.

The Rivalry between the two Principal Systems of Electrical Supply—The Cost of Lighting by Primary Batteries—Electric Lighting in Canada—A Householder objects to Electrical Mainlaying.

The rivalry between the partisans of the alternating transformer and direct low-pressure systems of supply is very keen everywhere, especially in the United States, where Westinghouse represents the former and Edison the latter. It is pretty well established that the alternating transformer system wastes about half of the power generated in the driving plant, and that the insulated cables used for conveying the current do not last longer than three or four years. On the other hand, the Edison plan requires, as we recently pointed out, a great outlay of capital in copper; and after all, if secondary batteries are used to minimize the risk of accidental extinction, the duty at the lamps is very little higher than in the other system. But neither in the United States nor in this country do the companies committed to either of these systems exhibit their working accounts in a way to enable outsiders to form correct views as to which is the better and more economical. All the comparisons of cost of the two systems that we have ever been able to get hold of are of the nature of estimates based upon laboratory experiments. Only a fortnight ago, our contemporary the *Electrical Review* had a long article on the rival systems, which on examination proved to be based on nothing more than a report as to some experiments with certain alternating transformer plant by a pair of American physicists. Of course, another American electrician has tried to make use of this report for his own purpose, which is to prove that the Westinghouse plant is not so good as the Edison. It is truly remarkable, when it is remembered that electric lighting companies working all sorts of systems have been in existence for several years, how difficult is the task of getting at the truth about their financial condition. The only certainty about this matter is that most electric light companies' shares can be had a bargain by anybody who cares for them.

An interesting report on the Weymersch primary battery for electric lighting has been prepared by Messrs. H. Alabaster, Gatehouse, and Co., which is worth placing on record as showing the cost at which lighting by primary batteries can be done. A vast amount of nonsense has been talked on this subject, even if we exclude the absurd claims of those battery-mongers who have promised to light lamps for nothing and pay a profit out of the residuals. The Weymersch cell seems an honest affair; nothing more being claimed for it than it is capable of performing. It is of the double fluid type; the electrodes being zinc and carbon, with dilute sulphuric acid as the exciting medium, and a depolarizing solution containing several well-known ingredients, the proportions and preparation of which are kept secret. These liquids are separated by a porous pot or plate. A battery of 42 cells, containing upwards of 280 lbs. of zinc plates, was used to supply the incandescent circuit; and the consumption of zinc was only 28 per cent. in excess of that theoretically necessary to produce the same electrical energy. The cost of the materials alone, leaving out of consideration depreciation, cost of maintenance, labour, &c., to produce one unit of electrical energy, was found to be 2·13s. Stating the same result in another way, a 16-candle power incandescent lamp would cost 1·275d. per hour on the same basis. This, of course, puts lighting by primary batteries "out of the running," so far as practical work is concerned, though the Weymersch battery may be a convenient toy for an amateur of electric lighting in a small way.

According to a paper read by Mr. A. J. Lawson before the Canadian Society of Civil Engineers, there were in January of the present year 1185 electric lighting companies operating central stations in the United States, 147 in Canada, and 25 in Central America, besides 266 gas companies engaged in electric lighting; making a total of 1623 public electric lighting plants in the North American Continent. Besides these, Mr. Lawson reckoned 4300 isolated or private plants, large and small. The number of arc lamps in use is about 235,000, of which about 68,000 are of the Thompson-Houston Company's make, and 49,000 are Brush lamps. Between November, 1886, and January, 1890, the number of incandescent electric lamps in America more than quadrupled—increasing from 525,000 to 2,500,000. At the present time Mr. Lawson estimates that there are fully 2,800,000 incandescent lamps in use, of which 808,500 are supplied from alternating current plants. The total capitalization of electric lighting and electric manufacturing companies in America is stated at $250,000,000 at the present time. As we have previously remarked, when giving similar estimates, these good, round, mouth-filling totals would probably be found to bear substantial reductions if tested for some purposes—say, with a view to taxation. With regard to the spread of electric lighting in Canada, which is rarely talked about, Mr. Lawson states that there is hardly a village in the province of Ontario, with a population of more than 3000 inhabitants, which has not an electric light station of some kind; and few of the important towns of the other provinces are without electric lighting. Most of these, it is admitted, are arc lighting stations; but about a dozen supply incandescent lamps, chiefly to stores and public buildings—"the lighting of residences being yet scarcely entered upon." Arc lights are chiefly used in the streets, for which incandescent lamps have been proved unsuitable; and it is remarked that the incandescent light has failed to meet the expectations of its advocates, who predicted it would prove much more brilliant than gas. It may be gathered, from Mr. Lawson's account, that most of the electric lighting in Canada is of the same rough-and-ready character that is made to do duty in the United States.

Mr. F. C. Burnand has written to *The Times* to complain of the proceedings of the Kensington and Knightsbridge Electric Lighting Company, who are laying underground wires along the road in which he lives. It appears that after the first job of the kind, during the execution of which all the houses were rendered unapproachable by wheeled vehicles, it was discovered that the work had to be done over again, the wires having been laid wrongly, and mixed up in some unexplained way with the gas-mains and drains. Mr. Burnand wants to know how many more visitations of the kind he will have to endure. The complaint, trivial as it is, shows the inconvenience of according statutory powers to inexperienced companies for interfering with public thoroughfares. The residents cannot be directly consulted in matters of this kind. They do not receive notice of what is about to be done to the roadway in front of their door; and when, after arranging for a ball or a dinner party a week or so in advance, the householder finds a yawning trench separating his residence from the world, he is apt to explode in wrathful condemnation of everybody concerned. It is to be hoped that the electrician will take warning from Mr. Burnand's complaint, and cause householders as little annoyance as possible.

ACCIDENTS WITH MINERAL-OIL LAMPS.

There has just been printed, as a parliamentary paper, a valuable and interesting report from Colonel Majendie, C.B., Her Majesty's Chief Inspector of Explosives, on the subject of accidents with mineral-oil lamps. Colonel Majendie's report covers a joint report from Sir Frederick Abel and Mr. Boverton Redwood, which may be regarded as a supplement to the report made by the same authorities in 1885, and used by the Metropolitan Board of Works as the basis of a circular issued for the instruction of manufacturers and users of oil-lamps. This matter was dealt with in the Journal at the time. In taking up the subject afresh, therefore, Colonel Majendie has been able to refer to this prior action of the Metropolitan Board of Works, and ascertain how far the suggestions made five years ago for the diminution of oil-lamp accidents have been acted upon, and with what results. The subject is admittedly a difficult one, and Colonel Majendie divides into two classes the difficulties that most particularly beset anyone who would prevent or diminish oil-lamp accidents. In the first place, it is difficult to settle upon the precautions and methods of construction which should be adopted to afford a reasonable measure of safety; and secondly, there is the difficulty of enacting and enforcing such regulations and precautions in the manufacture and use of lamps as may be found desirable in the public interest. When the subject of mineral oil legislation was occupying Colonel Majendie's attention in the early part of last year, he thought it desirable to enquire of Sir F. Abel and Mr. Redwood as to what effect, if any, their 1885 report and the action on it of the Metropolitan Board of Works had had on the lamp trade. Fifteen months later he obtained the report that is now published. The time has not been wasted; for it has enabled the writers to collect and digest some necessary data, which elucidate the causes of lamp accidents and the means whereby they may be prevented. These constitute the bulk of the report now under notice.

It is remarked that a large proportion of the accidents ascribable to the use of mineral-oil lamps are not due to explosions of the lamps themselves. Many recorded instances of the breaking out of a fire, or injury to the person, which are referred to lamp explosions, have evidently been caused by upsetting or dropping a burning lamp. The sudden cooling of a glass reservoir which has been much heated by the burning of the lamp may also result in its fracture. The substitution of benzoline for mineral oil is also a cause of "accidents." There are, however, numerous cases on record of veritable explosions in oil-lamps, with regard to which the writers have, by their experiments, arrived at the following conclusions: If the lamp is carried about or rapidly moved while alight, so as to agitate the oil, a mixture of vapour and air may escape from the reservoir, in close proximity to the flame, and by taking fire determine the explosion of the mixture existing in the reservoir. This escape may occur through the wick-tube itself, if the wick does not properly fit it, or through openings which exist in certain lamps near the wick-tube. Some lamps have inserted in the burner a tube through which the reservoir can be supplied with oil; and,

unless effectually closed, this tube may act as a passage for flame to the explosive mixture inside. There are other ways by which flame may get at the interior of a lamp reservoir. The practice of blowing down the chimney to put the lamp out is a hazardous one; and if the flame is very much lowered, so as to burn beneath the dome, the lamp may become dangerously overheated. The accidental dropping of the still burning wick into the oil reservoir, through turning it down below the level of the toothed wheels in the act of extinguishing the lamp, is also a very fruitful source of explosions.

Experiments have demonstrated that the burning of an oil of comparatively high flashing-point is more likely to cause heating of the lamp than the use of an oil of comparatively low flashing-point. It therefore follows that safety is not to be secured simply by the employment of oils of rather high flashing-point; and that the use of such oils may even, in certain cases, give rise to dangers which are small, if not entirely absent, with oils of low flashing-point. The character of the wick materially affects not only the illuminating power of the lamp, but also its safety. A loosely-plaited wick of long staple cotton draws up the oil freely and regularly, even when the supply of liquid in the reservoir becomes almost exhausted; and little charring of the wick takes place if the oil is of good quality. If contrary conditions prevail, the wick chars and the burner becomes heated.

A table is given containing somewhat minute particulars of 29 cases of lamp accidents, compiled from information supplied by Mr. Alfred Spencer, of the London County Council. Of these cases, eleven were spontaneous explosions while the lamps were burning normally. In two cases the lamp exploded spontaneously some time after it had been turned low. In six cases the lamp exploded on being extinguised by lowering the wick, and scattering the burning oil. In two of these cases fatalities ensued. In one case the lamp exploded on blowing down the chimney, causing death. In two cases the lamp exploded on blowing at the burner, causing death in one instance. One lamp exploded on being moved. Five cases out of the 29 resulted in death. Twelve of the lamps were made by well-known firms; the others being cheap articles. Twenty-five were table-lamps. The accidents happened at all stages of burning, and in all conditions of the oil reservoir. The oil, when it could be tested, was very generally well above the legal flashing-point. This table, in short, offers most disturbing evidence of the dangers of oil-lamps, even when used under apparently normal conditions.

From their observations and experiments, Sir F. Abel and Mr. Redwood conclude that the most general description of accident—those that arise from fracture of the oil reservoir—may obviously be prevented by making the reservoir of metal; although the use of metal for such a purpose is not free from objection. It is a disadvantage not to be able to see how much oil the vessel contains; and the oil has a greater tendency to creep over the outside of a metal lamp-body. It has been urged that the higher conductivity of metal for heat is a serious defect; but the writers do not think this amounts to anything. In dealing with accidents of the second class—those due to explosion—general principles of construction have to be considered. If a lamp is furnished with a well-fitting wick, provided with an extinguishing appliance, and constructed with a metallic reservoir of ample strength, an explosion is not likely to occur; or if it does, it is not at all likely to be dangerous. The writers admit that, in the recommendations to manufacturers of lamps which they formulated in 1885, some may be regarded as alternatives of others specified; and consequently the embodiment of all in one lamp is not necessary in the interests of safety. Thus, they advised that all channels of communication between the frame of the burner and the interior of the oil reservoir should be protected with wire gauze of 28 meshes to the inch, of the kind used for miners' safety-lamps, or that the wick beneath the burner should be enclosed in a cylinder closed in at the bottom, and constructed of the same kind of wire gauze, or in a thin sheet-metal tube. It was further recommended that the oil reservoir should not have any opening or feeding-place other than that provided by taking out the burner; and while indicating that the lamp should have an extinguishing apparatus, it was shown how one not so provided should be extinguished. Obviously, if the burner of the lamp is properly protected by one of the methods specified, the provision of an opening for the introduction of oil to the reservoir is not a source of danger, even if not always perfectly closed; and with similar circumstances it is not so necessary that a lamp should have an extinguisher. Bird-fountain lamps are classified as free from risk of explosion.

In order to ascertain how far their earlier recommendations had taken effect in the trade, Sir F. Abel and Mr. Redwood sent circulars to the principal makers and dealers in the country, inviting specimens of lamps designed to provide security against fracture and explosion. At this point several gaps appear in the printed report, as though to indicate that particulars of these exhibits had been suppressed, probably to avoid the conversion of the document into an advertisement by interested parties. At any rate, no description of any of these lamps is given; but the general conclusions drawn from the inspection are stated. Almost the whole of the patterns sent in were furnished with metallic reservoirs, and the voluntary adoption by the lamp makers of this important point of the recommendations of 1885, and also in the very general provision of an extinguishing appliance, are mentioned by the writers as evidence that their suggestions were practicable as well as sound. Substantial progress has been made by reputable manufacturers in rendering their lamps safe; but the report states that there is much room for improvement in this regard in the lamps now chiefly sold among the poorer classes.

Altogether, this paper may be recommended to gas managers desirous of collecting the most important facts relating to the popular use of mineral-oil lamps, which are acknowledged to be the most serious rivals of gas all over the world. It shows that although, thanks in a great measure to Sir F. Abel and Mr. Redwood, people who can afford to buy good lamps have a better chance now than they once had of obtaining reasonably safe articles, yet there must be vast numbers of lamps in nightly use which might at any moment repeat the ghastly record of death, mutilation, and damage tabulated by the framers of this report. The most discouraging fact about many of these accidents—and it must be remembered that they represent only a selection from a great number, and are gathered from the records of a single district—is that in the majority of cases they could hardly have been foreseen, or avoided by care on the part of the victims. Now, when a person enters a room in which there is a strong smell of gas, and proceeds to strike a light in order to look for the cause, he has his own folly to thank for the unpleasant consequences likely to ensue. It does not appear, however, that anybody can tell precisely when an oil-lamp is about to explode and scatter flaming oil over the apartment. All that can be said on this head is that if a lamp reservoir is of metal (which until recently was seldom the case); if the reservoir is fairly full; if the burner is tightly screwed in its place; if the wick is the proper size for the tube, and the proper length for the reservoir, and is also of good quality; if the reservoir does not leak, nor the oil creep over its outside; if the oil is of the right brand, neither too light nor too heavy; if the whole lamp and its accessories are kept perfectly clean, sound, and in good order within and without; if the lamp is burnt at its full power when lighted, and extinguished by some mechanical means; and, finally, if it is never carried about, shaken, or knocked over while burning—then no very serious accident is to be expected from its use. When one remembers how often these conditions are unsatisfied in the actual treatment of lamps by their users, to say nothing of the shortcomings of makers and vendors of lamps, oils, and wicks, it becomes wonderful, not that there are so many lamp accidents, but that there are not many more.

Mr. George Shepard Page, who has been in England for a considerable time over the negotiations that have resulted in the great Anglo-American Gas Trust, leaves Liverpool to-morrow (Wednesday) for New York in the *Teutonic*.

Mr. T. R. Dickinson, Assoc. M. Inst. C. E., the Deputy City Surveyor of York, has been appointed, out of 88 applicants, Borough Surveyor, Water-Works Engineer, and Inspector of Nuisances to the Corporation of Hertford.

Institution of Civil Engineers.—The Council have re-appointed as Treasurer Mr. Hugh Lindsay Antrobus, the senior partner in Messrs. Coutts and Co.; as Honorary Secretary, Dr. William Pole, F.R.S.; and as the Secretary, Mr. James Forrest, which office he has filled for the past 34 years.

Gas-Works in Sweden.—According to the latest official statistics, there are in Sweden 26 gas-works, having an annual production of 694,357,425 cubic feet of gas. The largest are those in Stockholm, Gothenburg, and Malmö; and the smallest, the one at Södertelze, with an annual production of only 784,000 feet.

Retirement of Mr. Charles Nettleton, of New York.—We learn that Mr. Charles Nettleton, of New York, is about to retire from his profession as an attorney-at-law. Mr. Nettleton was the first Secretary of the American Gaslight Association; and he has a number of friends in gas circles whose best wishes will follow him in his retirement.

Pensions for Gas Workmen and their Widows.—We learn from *Industries* that the Imperial Continental Gas Association have framed new rules for the pensioning of their workmen in Holland. Only those employees who have served the Association for 25 years, and are 50 years of age, are entitled to a life pension. Should a medical examination show that they are unfit for further work at this age, they are to receive a full pension, equal to one-half the wages earned in the last year preceding the pensioning. Should they, on the other hand, continue in the employ of the Association, the pension will increase year by year by a fiftieth part of the year's wages. Widows receive one-third of the pension-money to which their husbands were entitled.

Electric Lighting at Trient (Austria).—According to the Vienna correspondent of *The Times*, the electric lighting in the old episcopal city of Trient, to which reference was made in the JOURNAL for the 10th ult., is not working satisfactorily. The system was introduced at the beginning of last month. Close upon midnight on the 27th, all the lights were suddenly extinguished, and the place was of course plunged in darkness. The day had been kept as a public holiday in honour of some local festival, and the streets happened to be full of people; so that a great deal of confusion ensued. The street lamps were re-lighted after an hour's interval. The authorities believe the extinction was due to an act of malevolence; and a judicial inquiry into the affair has been ordered.

NOTES.

The Question of the Coal Supply.

In connection with the British coal question, a paper recently read before the Royal Statistical Society by Mr. G. G. Chisholm may be referred to with interest. Mr. Chisholm has endeavoured to make a comparative examination of the coal and iron production of Great Britain, and the principal coal and iron producing countries of the world, with a view to throwing light, if possible, on the future of the British coal supply. He has accordingly investigated the rate of expansion of the output of the different countries, with the result that since 1860 the growth is shown to have been less rapid in the United Kingdom than in several other countries, notably the United States and Germany. If the same average rates of expansion were continued indefinitely in the future for the United Kingdom, the United States, and Germany respectively, as are found to have prevailed in these countries between the mean of the three years 1879-81, and the mean of the three years 1886-88, then the coal production of the United Kingdom would be overtaken by that of the United States in 1894, and by that of Germany in 1928. A similar examination of the rate of growth of the production of iron shows that in this industry these two countries appear to be gaining still more rapidly on Great Britain. This is important, as tending to bring about a diminution in the rate of increase in the demand for British coal. Sooner or later, moreover, the demand for railways will be checked, and this will re-act on the coal market. With regard to the consumption of British coal, although commendably diffident of the value of conclusions drawn from such data as are dealt with in his paper, Mr. Chisholm thinks there is no reason to anticipate at any time anything of the nature of a disaster or sudden catastrophe from the continual demand. The change of conditions will probably be a gradual one throughout. First, we may expect only the continuation of a process already begun—a gradual contraction in the rate of expansion of the coal consumption. This may pass insensibly into a stationary state of coal production, to be followed by a gradual decline. In short, it looks likely that the history of individual coal-pits will be repeated by the whole coal-mining industry of the country; and it is to be hoped that the change will be gradual enough to allow of the habits of the people being altered in accordance with their circumstances. Still, it may be otherwise; and Mr. Chisholm gives an account from Richthofen of certain great Chinese coal-fields, the produce of which, if made available, may "bring about a revolution in the commerce and intercourse of the world."

Cause of the Violet Flame Produced by Salt on Burning Coke.

Referring to the conclusions of M. Salet, as to the cause of the blue flame appearing when common salt is thrown upon burning coke, which were given in a "Note" published in the JOURNAL for the 17th ult. (p. 1121), Mr. A. Percy Smith writes to the *Chemical News* to correct the statement that the appearance in question is due to copper. He contends that, in the first place, M. Salet errs in describing the flame as of a blue colour. It may indeed be blue, Mr. Smith admits, when copper chloride is heated; but all other chlorides produce a violet flame. Mr. Smith is confident that the usual violet flame is due to hydrochloric acid, and not to copper, for the following reasons: The chlorides of ammonium, potassium, sodium, strontium, barium, and mercury all produce the violet coloration when heated on wire gauze or in a porcelain crucible by coal gas, a spirit-lamp, or pure hydrogen. In these experiments no copper was present, and yet the spectrum of the flames was identical with that of the flame appearing when salt is thrown into a coal fire. Only two elements were present in common in these experiments—chlorine and hydrogen. Mr. Smith says he proved conclusively by other experiments that neither sulphur nor carbon entered into the reaction, notwithstanding assertions that had been made to the contrary. The violet flame may be produced by introducing a drop of hydrochloric acid upon a loop of platinum wire into a Bunsen flame, or a flame of pure hydrogen. Mr. Smith's proof of the origin of this appearance rests upon the fact that when pure hydrochloric acid gas is slowly passed into either of the above flames, the violet colour is abundantly formed. The chloride spectrum is the same under all methods of production given above; that is to say, hydrochloric acid heated in the flame gives identically the same result as common salt thrown into a coke fire.

Processes for Preserving Iron from Rust.

Besides the Bower-Barff furnace process for protecting iron by covering it with a deposit of the black or magnetic oxide, which is not liable to corrode, and the numerous copies of this method to which reference has been made from time to time in the JOURNAL, the same object is attained by the De Meritens electrolytic process. In this method the object is immersed near the anode in a bath of distilled water heated to 80° C.; a plate of copper being the cathode. The action that goes on results in the formation on the iron of a layer of magnetic oxide, which is treated afterwards in the ordinary way by oiling, &c., according to the style of surface required. Peroxide of lead can also be used for the same purpose; it gives a black, very adhesive deposit by the electrolysis of an alkaline solution of litharge. According to *La Lumière Electrique*, an analogous process, the invention of Mr. Haswell, has recently been experimented with in Vienna. In this process iron or steel is plunged as an anode in a bath containing from 0·5 to 5 per cent. of chloride or sulphate of manganese, with from 5 to 20 per cent. of nitrate of ammonia. The electrolysis is effected in the cold bath, with carbon cathodes. Feeble currents of from 0·1 to 0·2 of an ampère cover the iron with a deposit of peroxide of manganese, which adheres well and is not subject to further oxidation. In view of the modern revival of artistic blacksmiths' work, there is likely to be a brisk demand for these preservative processes, which while they do not hide the hammer work like paints, shall be even more effectual in preventing rust.

Paris Water Supply.—Last Tuesday, the Senate passed the Bill introduced into the French Chamber for improving the water supply of Paris by tapping the Vigne and the Verneuil, in the valley of the Avre.

The Recovery of Sulphur from Alkali Waste.—Mr. Justice Kekewich recently had before him an important action relating to the extraction of sulphur from alkali waste. It was brought by Mr. Rawes, the owner of patent No. 1393 of 1882, for "Improvements in, and in apparatus for, obtaining sulphur and some of its compounds from alkali waste," for an infringement of the patent by Messrs. Chance Bros., of Oldbury. The defendants denied infringement; and set up want of proper subject-matter for a patent, anticipation, insufficiency of specification, and other defences usual in patent actions. A strong array of Counsel appeared for the respective parties—the Attorney-General (Sir R. E. Webster, Q.C., M.P., leading for the plaintiff, and Mr. Horace Davey, Q.C., for the defendants. The case of the former occupied the Court six days; and at its close the parties agreed to a compromise, the exact terms of which were not disclosed. The Attorney-General, however, in making the announcement, stated that they involved the acquisition of the patent by the defendants, and the withdrawal of the action. He further stated that the charges of infringement had not involved any imputation of unfair dealing on the part of Messrs. Chance Bros. By a paragraph which appears elsewhere, our readers will see that this firm has now been converted into a limited liability company.

Coal in South Africa.—In the course of an interesting lecture lately delivered by Mr. W. Arnott, at the Young Men's Christian Association, Cape Town, on the subject of the products of coal, he pointed out that South Africa is not behind other countries in the richness of its mineral resources. The coal-fields cover a fairly symmetrical area, embracing parts of Cape Colony, the Transvaal, the Orange Free State and the whole of Basutoland. The greatest length and breadth is 500 and 200 miles respectively; and it has an area of 56,000 square miles. At the Molteno in Cape Colony, in Natal, and in the Transvaal and other places, workings are being carried on. Coal out of the Transvaal mines has been tested, and has been found to be good gas-producing coal. This vast coal basin, it seems, is practically unexplored; but Mr. Arnott thought it was certain that further systematic researches would be rewarded by the discovery of coal capable of supplying the wants of South Africa for many generations. The coal varies in quality in different places. In some, it is anthracite; in others, semi-bituminous. The Dundee Company's mines alone will produce 6000 tons of coal yearly; and when the present mines are all in working order, 120,000 tons per annum will, it is believed, be turned out. The lecturer thought more attention should be paid generally to the coal question; and expressed the opinion that capital sunk in coal mines would tend more to the improvement of the colony than money invested in gold shares.

Proposed Conversion of the North of Ireland Association of Gas Managers into a "National Association."—It may be remembered that at the meeting of the North of Ireland Association of Gas Managers at Dundalk last August, some discussion occurred as to the advisability of extending the name and operations of this newly-formed body, so as to embrace the whole of the country. With the object of testing the feeling of the constituency at large on this subject, the Honorary Secretary (Mr. James Whimster, of Armagh) has just sent a circular-letter to all gas managers in Ireland of whom he can find any record, in which he says: "The Committee desire to call the attention of their professional brethren in all parts of Ireland to the question opened up at the annual meeting in Dundalk last year, of the propriety of changing the name of the Association. It was formed in 1887; and the title then assumed indicated it to be a District Association. But seeing that there is no other similar Society in Ireland, it has been proposed to alter the title, which would, of course, alter its character, as it would no longer be a District but a National Association. The present members would be pleased, if it be the wish of their brethren in other parts of the country, thus to merge themselves into a General Association for the whole of Ireland. It is desirable, before any change is effected, to know whether it is really wanted, and whether, in the event of such a change taking place, the Committee could rely on the active co-operation in the work of the Society of the majority of Irish gas managers." For this purpose a form is enclosed with the circular, which Mr. Whimster asks to be returned filled up and signed, not later than the 10th inst.

TECHNICAL RECORD.

SOCIÉTÉ TECHNIQUE DU GAZ EN FRANCE.

Annual Congress in Lyons.

The Seventeenth Annual Congress of the above Society was held in the Philharmonic Hall, Lyons, from the 17th to the 19th ult., under the presidency of M. LE TREUST. The general arrangements for the meeting were set forth in the JOURNAL for the 17th ult., and the following particulars as to the business transacted are translated from the report of the proceedings which appears in the current number of the *Journal des Usines à Gaz*, the official organ of the Society.

At the opening of the congress on the morning of the 17th, there were 150 members present. This was a falling-off as compared with last year, when the number assembled in the Gas Pavilion in the grounds of the Paris Exhibition, where the meeting was held, was 280. In 1888, however, when the members met at Boulogne, there were 126 present at the opening. The first business was the reading of the official report of the previous meeting, which was adopted. The names of the new members and associates proposed for election were next submitted and approved; the President of The Gas Institute (Mr. J. Hepworth, Assoc. M. Inst. C.E.) being, as usual, admitted an honorary member. The report of the Committee on the general progress of the Society during the year was then read by the President; the greater portion of it being devoted to notices of the members who had passed away since the previous meeting. In consequence of death and other causes, the number on the roll was reduced from 576 to 551; but with the new-comers, the total was brought up to 585—consisting of 18 honorary and 484 ordinary members, and 83 associates. Particulars were also given of the contributions to the funds of the Society by various gas companies, amounting to 22,225 frs. (£889.) The Treasurer (M. Deleury) then presented a report on the financial position of the Association. It showed that at the close of the past year the capital had increased from 100,872 frs. (£4035) to 104,253 frs. (£4170)—an increase of 3381 frs. (£135). The next business was the election of members of the Committee to replace M. de Loriol (deceased) and the members retiring by rotation, but eligible to serve again. The ballot resulted in the re-election of MM. de Lachomette, Coindet, and Salanson for three years, and the selection of M. Vautier and M. Delahaye as members—the former for three years, the latter for one year. This completed the general business at the morning sitting. Afterwards the Committee held a meeting for the election of officers for the current year, with the following result: *President*, M. Salanson; *Vice-President*, M. Melon; *Secretaries*, MM. Visinet and Delahaye; *Treasurer*, M. Deleury.

On the reassembling of the members in the afternoon, the President remarked that the thought of having, in accordance with usage, to deliver an Inaugural Address at the opening of the congress, had somewhat alarmed and embarrassed him. He had made a great deal of gas, and was devotedly attached to the profession; but though he had, for something like thirty years, studied with ardour every question—whether technical, administrative, or commercial—bearing upon the economical management of gas-works, he had never delivered an addrsss. Therefore, setting aside custom, and throwing himself upon the indulgence of the members, he would not attempt to do so on this occasion, but merely make a few observations on the events which had occurred since the previous meeting. Dealing first with the International Exhibition, he alluded to the important part played by gas—so much decried—in the *fêtes* held in the grounds (something like 80,0000 jets being alight, consuming about 250,000 cubic feet of gas per hour, on illumination days), and in the various galleries, where it represented motive power equal to more than 400 horses. The capabilities of gas were fully shown in the Gas Pavilion in the grounds, thanks to the active measures taken by the Committee, with M. Ellissen and M. Cornuault at their head, and the liberality of the Paris and other Gas Companies. The interest attaching to the display of gas appliances there made was shown by the number of distinguished persons who visited it; among them being the President of the Republic (M. Carnot), who devoted a portion of his first evening visit to the exhibition to an inspection of the interesting collection. M. Le Treust next alluded to the display of electric lighting, and remarked that while the light, with a few exceptions, was thoroughly satisfactory as employed at the exhibition, it left much to be desired as an illuminant for the public thoroughfares. In this respect it had not made the progress for which the public looked; and he thought the municipal authorities of Paris would not find the system economical, even when they themselves undertook the supply of the light. Then there were the dangers attending electric lighting, as shown by the recent fires and panics in theatres. All these facts, coupled with the non-success of the electrical business from a financial point of view, were calculated to reassure gas suppliers as to any injurious effect they might have on their business. Doubtless the field of operations of the electricians would become more extended. At the same time, that of the gas companies would not decrease; and if, after a few reverses, the electric light companies should give up their original idea of putting forward their product as something that would economically replace gas, and determine to offer it as a light of luxury, charging a remunerative price for it, it would then be to the interest of the suppliers of gas to furnish both lights. But if the gas industry had nothing to fear from the competition of the electric llght, there were causes which might very seriously affect the economical working of the undertakings engaged therein, and give rise to uneasiness in regard to the future. Taking first the rise in the price of coal, there was no doubt that those companies which had to submit to it, would witness a very serious diminution in their profits. There seemed to him to be no justification for this increase, which, being powerless to remedy, gas suppliers could only deplore; and therefore it behoved them to lay in a good stock of coal during the summer to enable them to meet the eventualities with which they were threatened next winter. Then there was the labour question—the strikes of workmen. This was a trouble which had not affected them generally; but no one could say how long he would escape it. The movement started in London, where it was energetically grappled with and overcome by Mr. George Livesey, the able Chairman of the South Metropolitan Gas Company, but at a pecuniary sacrifice of about £30,000; it was continued in Paris, where the stokers obtained so liberal a concession to their demands that they now held situations which, in point of salary, were such as to make engineers of thirty jealous of those who filled them; and, within the previous few days the men at the four gas-works in Lyons had gone out on strike, and left the Company's engineers to re-organize in a few hours the retort-house work, so as to prevent a failure of both public and private lighting in the grand old city in which they were assembled. The skill and energy with which they had done this well deserved the thanks of all their colleagues. This strike mania was a malady that threatened to become chronic; and while he did not believe that any systems of mechanical stoking would prevent the occurrence of strikes in gas-works, he thought they would minimize their efforts by facilitating the recruiting of workmen. The inclined retorts of M. Coze were certainly, he thought, better calculated than any other system to allow of the charging and drawing of retorts mechanically; but, however they might recommend themselves for adoption in future constructions, they had, unfortunately, only been adopted in exceptional cases up to now. In the majority of French gas-works the retorts were set on the horizontal plan, charged with the shovel or the scoop, and drawn with the rake. Of course, it was for the manager to choose the tools and the system of working best suited to his particular circumstauces. But in the matter of manning his works there was another point to be considered—viz., the amount of work expected from each man. His (the President's) opinion was that overwork should be avoided. It was in many cases better to increase the number of men in a gang than to pay higher wages to each individual member for extra labour performed. When additional work had to be done by a man, as would sometimes inevitably happen, he should be remunerated proportionately. He had generally found an arrangement of this kind work satisfactorily. With regard to the position of the gas industry in the future, he did not feel any uneasiness on account of the competition of the electric light, but rather in regard to the renewal of their concessions. It seemed to him, however, that if the prosperity of gas undertakings in general had raised about their directors and managers a number of jealous people—he might even say enemies—it was this very prosperity that would help them to overcome the difficulties attendant upon the renewal of their contracts, inasmuch as it would enable them to redeem quickly the invested capital, and form ample reserve funds, so as to make it impossible for more advantageous offers to be sent in at the end of the concession than those submitted by the company in possession. In conclusion, he counselled the exercise of care and discretion in the expenditure of money on works of first establishment, for the reason that extravagance in this direction would place a perpetual burden upon the undertaking.

At the close of the President's remarks, reports were presented on the papers submitted in competition for the Society's prizes. One of them was entitled "The Ventilation of Dwelling-Houses and other Buildings Lighted by Gas;" the author being M. Alfred Vanderpol, the Lyons representative of the Continental Gas-Meter Company.* For this *mémoire* the Committee awarded him a prize of 3000 frs. Another paper was on "Gas-Engines;" and its author (M. Chauveau) gained a prize of 1000 frs. A paper dealing with the effect of gas-works on underground waters, by M. Melon, brought its author a prize of 750 frs.

The next business was the award of premiums for the best papers presented at last year's congress. They fell to M. Delahaye, for his communications generally; to M. Salanson, for a note on "Photometrical Experiments;" and to MM. Aguitton and Debenoist, for their paper on "Gas Purification." The Society's gold medal for progress in connection with gas manufacture was awarded to M. Coze, of Rheims, for his system of inclined retorts.

*By inadvertence, the author of this paper was stated in the JOURNAL last week to be Mr. Eugene Vanderpool, of Newark (N.J.), who is a member of the Society. M. Alfred Vanderpol, was only one of the new members admitted at the meeting now under notice; and this will account for the mistake.—ED. J.G.L.

There were 65 applicants for the Society's prize of 200 frs., for aged and meritorious workmen; and out of these twenty were selected. Their ages ranged from 60 to 73 years, and their period of service in connection with gas-works ranged from 32 to 45 years.

The papers presented at the meeting will be noticed in subsequent issues of the JOURNAL.

THE BOARD OF TRADE AND ELECTRIC LIGHTING.

In the JOURNAL for the 10th ult., we noticed in our "Electric Lighting Memoranda" a paper recently read by Major Cardew, R.E., before the Institution of Electrical Engineers, dealing with the principles and practice of the Board of Trade (of which he is one of the Engineering Inspectors) in regard to electric light undertakings. In view of the position of the author, and of the interest attaching to the subject of his paper, we to-day commence the reproduction of it in full.

The first attempt to deal with the question of electric supply on the part of the Legislature was the Act of 1882. As notice had been given of many Private Bills to be brought in to acquire the necessary powers for a general supply, proceeding on very varying lines, it was thought that the time had come for a General Act dealing with the subject. The two principal objects of this Act were: (1) To empower electric supply companies, or persons or local authorities desirous of undertaking this supply for their own districts, to lay their mains in the public streets, and conduct the business of supply generally in a manner recognized by law; (2) to recover charges for supply made to consumers. At the same time, proper regulations and conditions were imposed upon the undertakers to secure the safety of the public and the adequacy of the supply; while the fear of creating a new perpetual monopoly was evidently present in the minds of the framers of the Act. This Act is so familiar that a short sketch of its provisions will be sufficient. It sets out by detailing the various ways in which statutory powers can be obtained. These are: (1) By Licence; (2) by Provisional Order; (3) by Special Act. The issue of Licences is left entirely in the hands of the Board of Trade; but the consent of every local authority affected must first be obtained. The original period for which a Licence is granted must not exceed seven years; but it may be renewed with the like consents. A Licence may be for "public purposes" or "private purposes." "Public purposes" only allows supply for the electric lighting of streets, public places, buildings, theatres, &c.; while "private purposes" allows general supply, not only for lighting but for any other purpose, except the transmission of any telegram. The Board are empowered to make such regulations and conditions in a Licence as they may think expedient. Provisional Orders in this Act may be granted without requiring the previous consent of the local authorities affected, but have no force unless and until confirmed by Act of Parliament. The period of an Order may be limited or unlimited in duration. There appears to be very generally diffused a mistaken idea on this point. Many people appear to think that a Provisional Order only lasts for 42 years or 21 years under the old Act. This, however, is quite a mistake. The Orders granted by the Board of Trade, and confirmed by Parliament, have hitherto been, without exception, I think, unlimited in duration. There are various provisions for the sale or transfer of the undertaking; including, in the case of a company, compulsory sale to the local authority. But these provisions may never be acted upon, and even if they are put in force they do not extinguish the powers granted. Section 6, with respect to regulations, is so important that it will be better to give the exact words.

> The undertakers shall be subject to such regulations and conditions as may be inserted in any Licence, Order, or Special Act affecting their undertaking with regard to the following matters: (*a*) The limits within which, and the conditions under which a supply of electricity is to be compulsory or permissive; (*b*) the securing a regular and efficient supply of electricity; (*c*) the securing the safety of the public from personal injury, or from fire or otherwise; (*d*) the limitation of the prices to be charged in respect of the supply of electricity; (*e*) the authorizing inspection and inquiry from time to time by the Board of Trade and the local authority; (*f*) the enforcement of the due performance of the duties of the undertakers in relation to the supply of electricity by the imposition of penalties or otherwise, and the revocation of the Licence, Order, or Special Act where the undertakers have, in the opinion of the Board of Trade, practically failed to carry the powers granted to them into effect within a reasonable time, or discontinued the exercise of such powers; and (*g*) generally with regard to any other matters in connection with the undertakings. Provided always that the Board of Trade may from time to time make such regulations as they may think expedient for securing the safety of the public from personal injury or from fire or otherwise, and may from time to time amend or repeal any regulations which may be contained in any such Licence, Order, or Special Act in relation thereto; and any regulations so made or amended by the Board of Trade shall, from and after the date thereof, have the like effect in every respect as though they had been originally inserted in the Licence, Order, or Special Act authorizing the undertaking; and every regulation so repealed shall, from and after the date thereof, be repealed accordingly, but such repeal shall not affect any liability or penalty incurred in respect thereof prior to the date of such repeal, or any proceeding or remedy which might have been had in relation thereto. Any local authority within any part of whose district electricity is authorized to be supplied under any Licence, Order, or Special Act may, in addition to any regulations which may be made under the preceding provisions of this section for securing the safety of the public, from time to time make, rescind, alter, or repeal bye-laws for further securing such safety; and there may be annexed to any breach of such bye-laws such penalties, to be recovered in a summary manner, as they may think necessary: Provided always, that no such bye-laws shall have any force or effect unless and until they have been confirmed by the Board of Trade and published in such manner as the Board of Trade may direct.

The proviso enabling the Board of Trade to make regulations from time to time, and to amend or appeal any regulation, is certainly a wise provision; and it has been largely carried into effect. The power conferred upon the local authority of making bye-laws for further securing the safety of the public should also be noted, and that this may be exercised even where they are themselves the undertakers. In the case of local authorities being undertakers, power is given for them to contract for the execution and maintenance of any works or for the whole business of supply; but they are forbidden to transfer or divest themselves of any legal powers or liabilities without the consent of the Board of Trade. As regards overhead wires, undertakers must get the express consent of the local authority for their erection along, over, or across any street, and the local authority may remove any electric line placed above ground without such consent; and even where such consent has been given, a court of summary jurisdiction may order the removal of any electric line on the ground of public safety. It must be noticed, however, that nothing in this Act empowers any interference on the part of the Board of Trade or any other authority with electric lines erected by persons who are not undertakers. The undertakers are not allowed to prescribe any special form of lamp, or to interfere with the use made by any consumer of the supply given to him; but no consumer is to deal with his supply in such a manner as to unduly or improperly interfere with the supply to other consumers. Any dispute as to this is to be determined by arbitration. There are provisions against undue preference on the part of the undertakers in their supply and charges. I take the meaning of these sections (19 and 20) to be this—that the undertakers may make any agreement as regards price, hours of supply, &c., provided that the price is not in excess of the maximum rates laid down; but that, where they have made any such agreement with any private consumer, any other private consumer may demand a like agreement, where the conditions are similar (also in the case of street lighting authorities), but not that a private consumer could demand to be supplied at the same rate as is agreed upon for the street lighting or for lighting a large theatre. Supply may be cut off for neglect of payment of charges due, but only until the charges and any expenses incurred in cutting off the supply are fully paid. Any unlawful and malicious injury of electric lines and works is made a felony; and any person who maliciously or fraudulently abstracts, or causes to be wasted or diverted, consumes or uses electric energy is declared to be guilty of simple larceny—in fact, to have stolen it. The purposes for which the officers of the undertakers may enter premises of consumers are strictly defined; and they have no legal right of entry with any other object than to inspect the electric lines and fittings of the consumer. The Board of Trade, however, so framed the Orders and safety regulations as to make it unlikely that any consumer would refuse entry to a properly authorized agent of the undertakers, if required by them to make an inspection of the electric lines and fittings. In the section of the Act providing for the protection of the Postmaster-General, it is curious to note that a distance of 10 yards was apparently considered as the outside limit of distance within which a telegraph line might be affected by an electric supply line.

The section of the Act dealing with compulsory purchase by the local authority after 21 years, has been made the scapegoat for the failure of the electric lighting "boom" of 1883. It is questionable, however, whether it had so much effect as is attributable to it in preventing capitalists coming forward to support electric lighting schemes, and also whether whatever checking influence was really due to it has not, in the long run, been as beneficial as a nipping frost in early spring in restraining youthful impetuosity. And I may remark that this clause did not excite any serious opposition at the time; in fact, the Bill was sent up from the Commons with a 15 years' limit and extended in the Lords to 21 years, which was considered ample time even by the persons best qualified to judge, as is amply demonstrated in the minutes of evidence given before the Parliamentary Committee.

In the amending Act of 1888, the first section has two important provisions:

> (1) Notwithstanding anything in the Electric Lighting Act, 1882, no Provisional Order authorizing the supply of electricity by any undertakers within the district of any local authority shall be granted by the Board of Trade except with the consent of such local authority, unless the Board of Trade, in any case in which the consent of such local authority is refused, are of opinion that, having regard to all the circumstances of the case, such consent ought to be dispensed with; and in such case they shall make a special report, stating the grounds upon which they have dispensed with such consent. The grant of authority to any undertakers to supply electricity within any area, whether granted by Licence or by means of a Provisional Order, shall not in any way hinder or restrict the granting of a Licence or Provisional Order to the local authority, or to any other company or person within the same area.

The second section repeals section 27 of the former Act, and substitutes 42 for 21 years as the time to elapse before compulsory purchase can be enforced. Section 3 gives power to the Board of Trade to vary the terms of compulsory sale in accordance with any agreement between the local authority and the undertakers. Section 4 is very important, as it empowers the Board of Trade to make regulations for the protection of the public safety and of telegraphic and telephonic lines in the case

of any electric lines used for the supply of electric energy, however laid or erected, and whether under statutory powers or not Perhaps I had better give the first part of this section:

(4) Where in any case any electric line or other work may have been laid down or erected in, over, along, across, or under any street, for the purpose of supplying electricity, or may have been laid down or erected in any other position for such purpose in such a manner as not to be entirely enclosed within any building or buildings, or where any electric line or work so laid down or erected may be used for such purpose otherwise than under and subject to the provisions of a Licence, Order, or Special Act, the Board of Trade, if they think fit may, by notice in writing under the hand of one of the Secretaries or Assistant-Secretaries of the Board of Trade, to be served upon the body or person owning or using or entitled to use such electric line or work, require that such electric line or work shall be continued and used only in accordance with such conditions and subject to such regulations for the protection of the public safety and of the electric lines and works of the Postmaster-General, and of other electric lines and works lawfully placed in any position and used for telegraphic communication, as the Board of Trade may by or in pursuance of such notice prescribe; and in case of non-compliance with the said regulations, then the Board of Trade may require such body or person to remove such electric line or work: Provided that nothing in this sub-section shall apply to any electric line or work laid down or erected by any body or person for the supply of electricity generated upon any premises occupied by such body or person to any other part of such premises.

The second sub-section provides for the Postmaster-General taking action himself in the case of lines not laid under statutory powers, in the event of actual interference with his telegraphic lines, provided that these lines are not already regulated by the Board of Trade. The general purport of the section is to place the responsibility for the proper regulation of electric supply wires generally on the Board of Trade.

We now come to the dealings of the Board of Trade with the subject; and I propose to consider in the first place the various forms of Provisional Orders granted under the General Acts. As Licences differ very slightly in form from Orders of the same date, it will not be necessary to discuss them. There are up to the present time four forms of Orders, differing materially from each other in several important respects, and showing, I consider, progressive improvement in the treatment of the subject as experience was gained. These are: (1) The 1883 form, of which Bradford is, I think, the only one now actually being worked, but some other local authorities are preparing to start under old Orders; (2) the Chelsea Order of 1886, and the St. Austell Licence of 1885; (3) the London Orders of last year, which form, I may point out, is only applicable to Metropolitan districts under the London County Council; (4) the model forms of Orders for this year, which are even now being modified in certain clauses, and will not attain finality until some points have been determined by the action of Parliament. There are slight variations in form among individual Orders, generally due to some local considerations; and in every case there are considerable differences between Orders granted to local authorities and those granted to companies.

The first matter in all the Orders is the interpretation clause. In this, an innovation very important to electricians was introduced last year—viz., the definitions of "energy" and "power:" "The expression 'energy' shall mean electrical energy; and for the purposes of applying the provisions of the principal Act to this Order, electrical energy shall be deemed to be an agency within the meaning of electricity as defined in the Electric Lighting Act of 1882." And "the expression 'power' shall mean electrical power, or the rate per unit of time at which energy is supplied." They hang upon the definition of electricity in the principal Act as "electricity, electric current, or any like agency"—rather a general definition, you see. Now the use of the term "energy" has, I consider, materially improved the language of the Orders, both from a scientific and a legal point of view. Under the old forms of Orders, the undertakers were authorized to supply "electricity;" and continual reference is made to this as the quantity supplied. Now, this word has, or had, many meanings; but in this case it could only mean electrical energy. But when we turn to the "price" clauses, we find that energy is expressly mentioned as differing from electricity, and that there, at all events, the latter meant what we now call "electrical quantity." There really was here some confusion of language, distressing to the electrician, and opening up grand possibilities of endless talk to lawyers. The proposed amendment was referred to the Council of the Institute, and concurred in by them; and I am glad to notice that the use of the term "electrical energy" is gradually working its way. I am not yet satisfied, however, with our word for what used to be the particular meaning of "electricity." It is rather absurd to call it "electrical quantity," since so many other things are electrical quantities. I almost think we want a word for this even more urgently than for electrical locomotion, over which so much ingenuity has been lately expended. The worst of it is that, as nobody knows what it is, or to what extent its existence is an objective reality, it is difficult to find an appropriate word. At any rate, it was impossible in the Orders to call it "electricity" any longer, as the Act says this is what is to be supplied; so that we had to define "energy" as what was meant by electricity in the Act, and use "electrical quantity" for the particular meaning for want of a better word. This also necessitated an alteration in the title. There is a slight further alteration in the new model title. As regards the definition of "power," this was necessary to avoid a difficulty in modifying a few clauses in the old Orders which dealt with the maximum current to any consumer to render them applicable to transformer systems. The definition of "main" has been materially altered. Thus it used to mean the conductor alone; then a continuous electric line, defined in the Act as follows: "The expression 'electric line' means a wire or wires, conductor, or other means used for the purpose of conveying, transmitting, or distributing electricity with any casing, coating, covering, tube, pipe, or insulator enclosing, surrounding, or supporting the same, or any part thereof, or any apparatus connected therewith for the purpose of conveying, transmitting, or distributing electricity or electric currents." And, lastly, the word "continuous" has been omitted as unnecessary in the case of transformer systems. The definition of "service line" has been altered in the same way. "Distribution main" has not been altered. It is a very important definition, as follows: "The expression 'distributing main' shall mean the portion of any main which is used for the purpose of giving origin to service lines for the purpose of general supply." Difficulties may arise in interpreting this, as for instance, in cases where the same conductor is at one part a feeder and at another a distributing main; but it is one of those things which must be left to custom and precedent. The other definitions need not detain us just now, except that two important ones have been added in the new forms: "The expression 'consumer' shall mean any body or person supplied or entitled to be supplied with energy by the undertakers." "The expression 'consumer's terminals' shall mean the ends of the electric lines situate upon any consumer's premises and belonging to him, at which the supply of energy is delivered from the service lines." The consumer's terminals are the point of demarcation between the possessions of the undertakers and their customers; they need not be binding posts.

In the clauses headed "Area of Supply," an important novelty was introduced last year, and has been retained in the new Model Order for companies, expressly prohibiting the undertakers from supplying outside the area granted to them without further statutory powers. This is a sacrifice of their common law rights which they are required to make in consideration of the special privileges they acquire. This provision is being carried out by mutual agreements between the London companies. The old Orders, and the Liverpool and Swansea Orders of last year, provided for the division of the whole area into two districts, scheduled A and B respectively; the A district alone being the area for which powers are immediately granted, and in which supply is compulsory; while the B district was intended to be added piece by piece, practically at the option of the undertakers. The general effect of this was to induce undertakers to apply for very large districts, the greater part of which were in the B schedules, over which they thereby acquired a sort of prior right of occupation without incurring any liability. This was altered last year and a single district substituted, to the whole of which the "compulsory works" clauses apply.

[Major Cardew then proceeds to deal with the nature and mode of electric light supply, and the regulations laid down to ensure safety; concluding with a description of the standardizing laboratory established by the Board of Trade. This portion of the paper will be given next week.]

Society of Arts.—At the meeting of the Council of this Society last Tuesday, Sir R. E. Webster, Q.C., M.P., was elected Chairman, and Sir Frederick Bramwell, F.R.S., Deputy-Chairman for the ensuing year.

The Electric Light in Holland.—The Town Council of Amsterdam have, says *Industries*, recently passed the Bill fixing the rules and conditions under which the electric lighting of the city is to be entrusted to those tendering in open competition for the contracts prior to September. The contractors are to be bound to pay the Corporation 5 per cent. per annum on all receipts. Of the balance, 6 per cent. is to go to the contractors, who are to receive one moiety of the surplus, the other moiety going to the consumers. The Town Council are to have the right to readjust the charges for electric lighting every five years, and may lower them if found unreasonable or excessive. In Rotterdam it is not proposed to offer the electric lighting of the town to open competition, but to place the control of the system in the hands of the Gas Committee. A large amount is to be devoted to the purpose of testing systems through a certain area for public lighting only, after which the conditions will be made known for the supply of private houses.

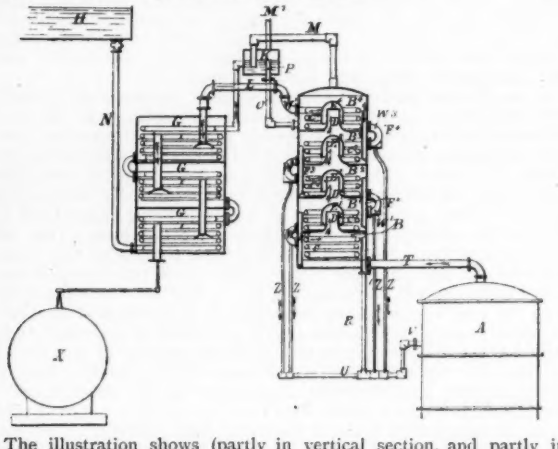
Water Supply in Mexico.—According to an extract from a letter by a correspondent of the *South American Journal* (which appeared in the *Board of Trade Journal* for the past month), the question of providing a proper water supply for the cities and towns of Mexico is engaging the serious attention of the inhabitants; and it seems to be probable that a number of waterworks and storeage reservoirs will be constructed in the course of the next ten years. The nature of the ground, being volcanic, has hitherto militated against the staunchness of the tanks and water reservoirs which have been built. But this difficulty will no doubt be overcome. In many towns recourse has been had to artesian wells; and good water has been struck, in most cases, at depths ranging from 500 to 1500 feet. There is a great demand for more of these wells; and some of the smaller cities, being unable to pay cash, would, the writer thinks, probably give valuable rights to sell the water for a number of years if obtained from an artesian well located within their limits.

REGISTER OF PATENTS.

Distillation and Condensation of Ammoniacal and other Liquids.—Solvay and Co., of Brussels. No. 8169; May 16, 1889. [8d.]

Heretofore, say the patentees, the apparatus used for the distillation of ammoniacal liquor, has been fed directly with weak ammoniacal liquor, either cold or heated, by passing through an apparatus for condensing the products of the distillation, or through a reheater. The ammoniacal liquor, before passing to the distilling apparatus, has lost none of its carbonic acid, sulphuretted hydrogen, and ammonia; and the products of distillation contain the whole of these gases, which were present in the liquors when they entered the apparatus. The products of distillation are usually directed into a condenser; and, according to the construction thereof, a small quantity of the carbonic acid and sulphuretted hydrogen may be sometimes disengaged. In no apparatus, however, so far as they are aware, are these gases removed from the ammoniacal liquors before they enter the distilling apparatus proper. This operation can, however, be effected by the apparatus forming the subject of this invention, and whereby a concentrated liquid may be obtained having a percentage in ammonia which may reach 32 per cent., and even more in some cases, and which only crystallizes on cooling to a temperature of nearly 0° C.

The construction and operation of the apparatus is based upon the difference in the degrees of solubility, at various temperatures, of the gases which are in solution in the liquid requiring to be distilled. The gases of different solubility are differently retained by successive washings in liquids having a variable temperature.



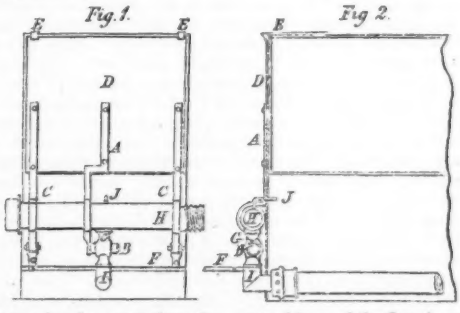
The illustration shows (partly in vertical section, and partly in elevation) the construction of the separator, having a multiple action, and suitable for the treatment of weak ammoniacal liquor for the manufacture of concentrated liquor. A is the main distilling apparatus (of any suitable construction). B B^1 B^2 B^3 B^4 are a series of chambers forming part of the separator, formed of trunks or tubular metal casings. C C^1 C^2 C^3 C^4 are coils of lead or other suitable metal; and D^1 D^2 D^3 D^4 are pipes carried by the bottoms of the chambers B, and serving for the passage of gases. E E^1 E^2 E^3 E^4 are plunger caps supported above the pipes D; and F F^1 F^2 F^3 F^4 are overflow-pipes for the passage of ammoniacal liquor from one chamber B to the other. G is the apparatus for condensing the gases proceeding from the main distilling apparatus; and H is a reservoir for supplying the weak ammoniacal liquor to be treated. I is a condensing worm or coil, through which the weak ammoniacal liquor passes. K is a washing apparatus supplied with liquor from the worm or coil I. L is a pipe for conveying gas and vapour from the upper coil C^4 to the condenser G, wherein they are condensed. M is a pipe for the disengagement of the gases which escape from the separator, and which are conducted to the washer K. M^1 is an outlet-pipe, to permit of the gases escaping from the washer K. N is a pipe for the conveyance of the weak ammoniacal liquor from the reservoir H to the inlet of the worm I in the condenser G; and O is a pipe for passing the ammoniacal liquor from the outlet of the worm I to the washer K. There is also a pipe for carrying the ammoniacal liquor from the washer K to the upper chamber B^4 of the separator R is a pipe for conveying the ammoniacal water from the outlet of the lower chamber B of the separator to the inlet V of the main distilling apparatus. T is a pipe for leading the products of the distillation from the distilling apparatus to the inlet of the worm C. U is a main-pipe for the condensed water from the worms $C^{1\,2\,3}$; and to it is joined the pipe R. X is a reservoir for storing the concentrated ammoniacal waters as they issue from the condenser G.

The course of the vapours from the distilling apparatus through the various apparatus, the course of the ammoniacal liquor requiring to be distilled, and the course of the gases disengaged in the chambers $B^{1\,2\,3\,4}$ are as follows:—The volatile products of distillation in the apparatus A pass through the pipe T, and enter the lower extremity of the worm C, flowing through the whole length, and continuing their ascending motion by passing from the worm C to the worm C^1 by means of the curved pipe W. In the same manner the products traverse the worm C^1, the curved pipe W^1, the worm C^2, the curved pipe W^2, the worm C^3, the curved pipe W^3, and the worm C^4, and pass to the pipe W^4. They are then led through the pipe L to the condenser G, wherein they are condensed by contact with the worm I, and pass in the form of concentrated liquor through the pipe S, which conveys them to the reservoir X. The products of the distillation are cooled in their passage through the various worms; a part of the steam and of the gases contained therein being condensed. Each of the curved pipes W may be provided with a pipe Z for collecting the products condensed in the worms $C^{2\,3\,4}$, and for conveying them to the main U, whence they are returned into the distilling apparatus at V with the ammoniacal liquor to be distilled. The ammoniacal liquor requiring to be distilled, and which is stored in the reservoir H, descends in a cold state through the pipe N, and enters the lower end of the lower worm I of the condenser G. The liquor circulates methodically through the worms I from bottom to top, and becomes heated by condensing the ammoniacal vapours, which obtain admittance to the condenser through the pipe L. The ammoniacal liquor heated to a suitable temperature (say about 40° C.) passes from the worm I and proceeds through the conduit C to the washer K, where the gases, escaping from the casing B^4, are washed, and freed from the ammonia which they may contain, the carbonic acid and sulphuretted hydrogen gases escaping almost entirely through the pipe M^1. The ammoniacal liquor afterwards descends through the pipe P, and enters the chamber B^4 of the separator. Here it becomes heated by contact with the worm C^4, and descends through the overflow-pipe F^4 into the chamber B^3, where it is still further heated by contact with the worm C^3. It then passes through the overflow-pipe F^3 to the chamber B^2, then through the overflow-pipe F^2 to the chamber B^1, and through the overflow-pipe F^1 to the lower chamber B, whence it passes through the overflow-pipe F and pipe R and enters the distilling apparatus V. The ammoniacal liquor is successively heated in each of the chambers $B^{3\,2\,1}$ at increasing temperatures as it passes from the top to the bottom of the separator. The evolution of carbonic acid and sulphuretted hydrogen commences to take place in the upper chambers B^4, B^3, and continues in the chambers B^2, B^1, and B; the temperature in the last chambers being such that the ammonia gases are disengaged at the same time as the other gases. They, however, bubble up in the liquid contained in the chambers B^2 B^3 B^4, which is of gradually decreasing temperature from bottom to top, and are condensed therein; whereas the carbonic acid and sulphuretted hydrogen are not condensed, and continue their ascending course through the apparatus in a gaseous state. The gases disengaged in chamber B pass through the pipe D^1, bubble under the plunger cap E^1, and, owing to this bubbling, favour the disengagement of the gases contained in the liquor within the chamber B^1, and carry them away through the pipe D^2 and under the plunger cap E^2, so as to bubble through the liquid within the chamber B^2, where they abandon a part of the ammonia, and convey away a fresh quantity of carbonic acid and sulphuretted hydrogen. The same actions take place in the chambers B^3 and B^4. The gases that escape through the pipe M are only carbonic acid and sulphuretted hydrogen and a minute quantity of ammonia, which is retained on its passage through the washer K. A small washer with acid may be used for finally washing the gases escaping through the pipe M^1 from the washer K.

The concentrated ammoniacal liquor obtained in the reservoir X may reach the desired richness in ammonia according to the working of the apparatus. A caustic liquid of a specific gravity nearing 1°, or even less than 1° or near 0° of Beaumé's areometer, may, say the patentees, be obtained at will, and contains from 20 to 30 per cent. of ammonia; or a liquid partially caustic and still more concentrated may be produced. They also remark that the separator or multiple-acting apparatus may advantageously be used in the purification of lighting gas; the use of caustic ammonia having already been indicated by chemists for this object. Their process, which provides an easy means of imparting causticity to the weak liquors produced in gas-works, is said to solve the difficulty which has heretofore stood in the way of this application.

Gas-Stove Cocks.—Hamer, F. G., of Torquay. No. 10,306, June 25, 1889. [6d.]

This is an invention whereby the main supply of gas to any apparatus is regulated by the movement of a flap-door; the hinge of the door being connected to the main stop-cock in such manner that the movement of the door acts on the stop-cock, and thus regulates the main supply of gas to the apparatus.



As shown in the engraving, the centre hinge of the flap-door is connected with a pin-jointed lever A, to the plug B of the gas-cock which regulates the supply of gas to the oven burner; and the two outer hinges C of the flap-door are connected to the apparatus under the oven doorway—one on either side. The flap-door D is made sufficiently large to cover the whole of the oven doorway, and is fitted with a handle (and latch) E at the upper end of it for opening and closing the door. When the flap-door is closed, it rests in a perpendicular position against the oven, covering the whole of the oven doorway; and when opened, it rests on a plate F, which projects from the apparatus under the oven doorway. One end of the barrel of the gas-cock G is fitted to the gas supply-pipe H, which runs along the front of the apparatus under the oven doorway; and the other end is fitted to an elbow I, connected to the burner, which runs along underneath the centre of the oven (inside) from front to back. One end of the oven burner is just under the pilot light J inside the oven near the door.

Gas Motors—Rowden, W. T., of Lenzie, N.B. No. 10,669; July 2, 1889. [6d.]

This invention is an improvement in gas motors constructed in accordance with patent No. 9705, of 1888; and the improvement consists in

constructing the link which connects the two cranks so that it may be adjusted in length, for the purpose of readily modifying the amount of the charge and the extent to which the gases expand after their explosion. In the former specification, it was stated that the ratios of the volumes of the gases at the ends of the four parts of the cycle of the engine—viz., at the ends of (1) expansion, (2) exhaust, (3) intake, and (4) compression—depend upon the ratios of the lengths of the different parts of the combination and the positions of the two shafts; but it was not claimed that any of the parts were made adjustable so as to give different volumetric ratios in the same engine after they had once been fixed.

The mode of making the link adjustable in length is a matter of indifference as far as the present invention is concerned, and many well-known devices are available. For applying the adjustable link, however, the patentee prefers the front piston to be connected to the pin of a double-cheek crank on the shaft which carries the fly-wheel and the back piston to the pin of the crank on the free shaft, by the return connecting-rod. With the relative lengths and positions of the various parts shown in a skeleton elevation, in the specification, and with the necessary amount of clearance between the pistons at the end of the exhaust part of the cycle, the relative volumes at the ends of (1) expansion, (2) exhaust, (3) intake, and (4) compression, differ but little from those obtaining in engines that expand only to the volume occupied by the gases immediately before compression commences; but by shortening the link, the volume after (1) expansion is increased, whilst the volumes at the ends of the other three parts of the cycle are decreased, though the ratios of these three are not materially changed. Thus if the normal expansion of an engine be made (say) 50 per cent. beyond the volume after (3) intake, more power can, if required, be obtained from it by lengthening the link, and thus taking in greater charges and working less expansively; while on the contrary, if less than the normal amount of power be needed, an economy of gas and a steadier engine will be secured by working more expansively and taking in a greater number of smaller charges. This is done by shortening the link.

Gas-Engines.—White, C., and Middleton, A. R., of Baltimore, U.S.A. No. 11,038; July 9, 1889. [11d.]

This invention in gas-engines is designed to simplify the construction of this class of machines to economize in the amount of gas used, to lessen the number of parts, and to make the engine in compact form; also to provide for the automatic governing of the engine without exterior connections to the operating parts, to prevent the discharge of any of the consumed products into the place where the engine is situated, and to provide generally an effective construction of the operating parts, whereby the working efficiency of the engine is increased over present forms of such engines, while the cost of construction is materially diminished. The invention includes in its structure a cylinder with a piston therein connected, by means of a pitman or a piston-rod to the driving-shaft, with an explosion chamber in the rear of the piston, having a suitable fuel supply leading thereto; an igniting orifice leading to the chamber; an auxiliary piston within the explosion chamber, acting as an automatic governor for the amount of fuel admitted to the explosion chamber, and controlling also the igniting of the fuel; and, finally, of means for controlling the movement of the auxiliary piston.

Retorts for the Production of Gas.—Sanders, F., of St. Petersburg. No. 11,125; July 10, 1889. [8d.]

This invention relates to retorts for producing illuminating gas, water gas, or a mixture of different gases, at will, and in accordance with the requirements of the particular purpose in view.

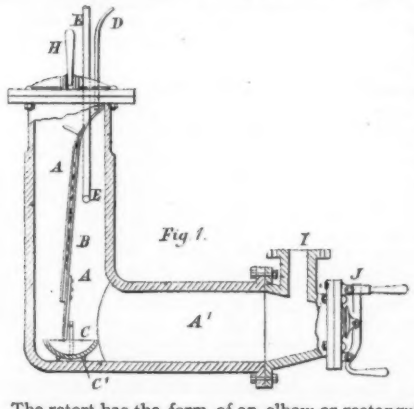


Fig 1.

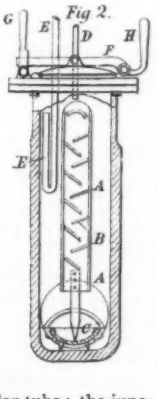


Fig 2.

The retort has the form of an elbow or rectangular tube; the junction of the two limbs being formed as an easy curve to better facilitate equal diffusion of heat over the body of the retort. It is mounted in a furnace in (substantially) the ordinary manner; the ends of the retort projecting outwardly from the furnace, and having tightly fitting covers, held thereto by levers, screws, or in an equivalent manner. The horizontal part of the retort is provided with a mouthpiece and cover having a tubular projection or flanged conduit pipe, for the issue of the gas formed in the retort, from whence it is conducted to purifying apparatus, as usual. In the vertical part of the retort, are a number of inclined plates or shields, with side walls or projecting edges or flanges and deflectors or intercepting shelves or steps of curved, inclined, or other form; each of these plates or shields being provided on its outer surface with inclined partitions or steps for a purpose to be explained. The shields are fitted with supports, and are held by a dished vessel or trough having pointed legs or projections with but very slight contact-surface where they rest on the retort; so that no avoidable area of surfaces are brought into contact, with the object of facilitating removal. The cover of the upper leg or end of the retort may be provided with a number of syphon-tubes with funnels (or other suitable form of conduit may be employed) for the introduction of fluids—either vaporous or liquid—to be converted into gas.

Fig. 1 is a vertical section taken lengthwise of the retort; the covers at each end being shown in side view. Fig. 2 is a vertical end section taken through the upright leg of the retort.

In the retort is a plate B, supported in the vertical leg A^1 on a support, which rests with its pointed end in the basin C, which again rests with its pointed feet C^1 on the floor of leg A^1 and beneath leg A. D is a pipe for leading hydrocarbon liquid on to the plate B, which has ribs or angular ridges to detain the liquid in its downward flow. E is a pipe for vaporous fluid—here shown as a downwardly hanging tube with straight return. But it may take any convenient form such as a coil or spiral; and the convolutions may pass around the plate B. The top of the open end of the leg A is flanged; and the cover is secured thereto by bolts and nuts. Centrally of the cover is an opening formed as a seating for the cover; the meeting edges of the cap and cover being packed to secure a complete fit. A convenient mode of connecting the cap to the plate, is by a cross-bar F hinged to the cover and to the cap; whilst the outer end of the bar is capable of being held or released by rocking the slotted rock arm G on its centre; the end of the bar being passed through the arm and locked by turning up the handle. H is a handle formed of a continuation of the bar F, and serving to aid in operating it. The open end of the horizontal arm of the retort is closed by means of a coned cover formed with a branch-pipe I, shown flanged for connection to any suitable pipe (not shown) for the conveyance of the gas to any suitable purifying apparatus. The opening in the cover is also flanged for convenience of attachment thereto of a flanged plate constructed with a central opening forming a packed seating for a plug or cover held thereto by the bar J.

The vapours produced hang for some time in the part of the retort A above the point where its inner wall bends round to form the upper side or roof of the leg A^1, exposed to the fullest heat, and eventually pass down along A^1 out at I. The vapours thus remain some time under the influence of a high temperature in the top portion of the vertical limb of the retort; and are transformed into a fixed gas, and finally issue through the mouthpiece of the retort and are led to purifiers. The retorts can be so arranged and employed that one retort can be making one particular description of gas, whilst another of like shape can be preparing superheated vapour of a like or different character, which can be sent into the retort first mentioned for mixture with the gas therein. Or one retort could be producing a gas from (say) crude petroleum, while one or more retorts could be producing each one, or mixed gases, and the gas from each retort could be led away independently into purifying apparatus, where they could finally mix together. For producing water gas, water or steam is let in through the conduit tubes, and crude petroleum oil (or coal tar, hydrocarbon oil, and the like) is dropped through the other tube on the extended inclined surface or shield.

APPLICATIONS FOR LETTERS PATENT.

9320.—Travers, T., "Improvements in gas-burners and apparatus for naphthalizing gas." June 16.

9360.—Lea, R. H., Brett, W. J., and Ward-Cooper, E. J., "Improvements in gas and vapour engines." June 17.

9394.—Chandler, J. C., "Improvements in charging gas-retorts, and apparatus therefor." June 17.

9420.—Williamson, T., "Improvements in reversing valves for regenerative gas-furnaces." June 18.

9449.—Mackinlay, R. W., and Darwin, H., "Improvements relating to gas-fires." June 18.

9479.—Williams, P. H., "Cooking, baking, boiling, heating, &c., by constructing apparatus of double bell or inverted vessels of any form, and also separately or combined therewith, superheating gas or gas and air burners." June 19.

9496.—Robson, G., "Improvements in gas or other motive power engines." June 19.

9521.—Mewburn, J. C., "Improvements in and connected with gas producers, or apparatus for producing gas to be used as fuel." A communication from O. W. Ketchum. June 19.

9527.—Mackinlay, R. W., and Darwin, H., "Improved valves for Bunsen gas-burners." June 19.

9531.—Mackinlay, R. W., and Darwin, H., "Improvements relating to gas-fires." June 19.

9539.—Herzog, C., "An improved gas generator to be independent of climatic variations." June 19.

9540.—Herzog, C., "An improved method of and means for the regulation of the quality of an artificial gas." June 19.

9559.—Richardson, W., "Improvements in joints or couplings for pipes." June 20.

9565.—Batey, G., "Improvements in or relating to metal pipe-joints and means for breaking the same." June 20.

9574.—Mackinlay, R. W., and Darwin, H., "Improvements relating to hot-air (gas) stoves." June 20.

9575.—Mackinlay, R. W., and Darwin, H., "Improvements relating to gas-fires." June 20.

9606.—Huhnermann, B., "Improved pipe coupling." June 20.

9645.—Cowan, W., "Improvements in prepayment gas-meters." June 21.

9731.—Raworth, J. S., "Improvements in meters for measuring liquids." June 23.

9733.—Pitt, S., "Improvements in the manufacture of illuminating gas." A communication from E. J. Jerzmanowski. June 23.

9740.—Cobbe, J., "Improved means of reflecting gas or any other artificial light." June 23.

9755.—Jaegarmayer, E., and Michel, A., "A rendement meter." June 24.

9881.—Bayly, J. P., "An improved valve-gear for gas-engines." A communication from W. Heckert. June 25.

9920.—Foley, W., "Improvements in galleries or holders for carrying globes for gaseliers and the like." June 26.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

Mr. West and the Assistant Secretary of the Gas Workers' Union.

SIR,—Mr. West, as is his wont, evades the points raised by me. I am fully aware that he could not directly discharge the clerks or bookkeepers at the Rochdale Road Gas-Works of the Manchester Corporation; but he does not say that it was not he who gave the cue to the Gas Committee. He says the clerks and bookkeepers were discharged for gross misconduct. I could mention one man who was there for upwards of 17 years, who never made any of the "endless mistakes" referred to, although the rates of wages were exactly the same, and who was discharged through the instrumentality of Mr. West.

Does Mr. West also deny reducing the yardmen's wages from £1 to 18s. a week, and making them come to work at six o'clock on Monday mornings (seven o'clock on those mornings being the time previous to Mr. West's appointment), while during his term of office seven o'clock on Monday mornings was the recognized time at the Gaythorn and Bradford Road stations, because Mr. Barratt, the Engineer at the Gaythorn station, would not allow Mr. West to interfere with the internal management of his works? Further, is he aware that I asked Mr. Adam Woodward, the Chairman of the Rochdale Road Works Committee, if he knew that the yardmen at that station were receiving 2s. a week less than the men at the other stations? Mr. Woodward told me he was not aware that that was so, but he would inquire. To his everlasting credit be it said, he did inquire, and found it correct, and soon rectified it; and the yardmen are now receiving £1 per week. Mr. West told me at the interview we had with him, that wherever he had the honour of being manager, he was always called "the workingman's friend." Well, I am sorry that we in Manchester could not give him that title; and I afterwards found, when I visited the Maidstone works, that the men there do not give it to him.

Mr. West, in his last letter, mentions the name of Mr. Chester, the esteemed Engineer of the Nottingham Corporation Gas-Works. Of Mr. Chester I can say that, while I worked under him in Manchester, I found him a thorough gentleman in his dealings with the men. On the Christmas Eve to which I have previously referred, when we put our tools down, Mr. Chester came as soon as he was wired for, and told us in the dining-room that it was not his doings that the day's wages should be docked; it was all due to Mr. West. This gentleman still lives, and so do a great many others; and seeing that I have monopolized a great deal of your valuable space lately, I will now wind up this affair by issuing Mr. West a challenge. It is this: That I, William Ward, will meet Mr. John West in the presence of Mr. William Rodgers (now Manager of the Bradford Road Works, Manchester), Mr. W. R. Chester, Mr. Shaw (the Cashier to the Manchester Corporation), and any number of others, at any time or place he wishes to name, and I will prove to his satisfaction that my statements are not "coined out of my imagination."

W. H. WARD, Assistant-Secretary,
Gas Workers' Union.

July 3, 1890

Stoking Arrangements at the Chester Gas-Works.

SIR,—In your report of the discussion on Mr. R. Mitchell's paper on "Eight *v.* Twelve Hours," I am made to say that "the men worked on Sundays from six in the morning till six at night, and the next gang worked until six on Monday morning." This is a mistake; and I must have been misunderstood by your reporter. Gas making here is *suspended* between the hours of six in the morning and six at night on Sundays. The gangs change round on Sundays. The men who leave off work on Saturday afternoon at two o'clock, start again on Sunday night at six o'clock, and work till six on Monday morning; thus making one twelve-hour shift. All other shifts during the week are eight hours only.

Chester, July 2, 1890. ROBERT HUNTER.

The Results Produced by Large and Small Gas-Works.

SIR,—I was pleased to read the few remarks made by Mr. A. Thomas, of Cowes, in the course of the discussion at The Gas Institute meeting on Mr. West's paper. I quite agree with him in his remark that the directors of country gas-works, when they see the results produced at large works, want to know how it is that the manager of a small works cannot realize the same.

I see that stoking machinery is all the rage now, for fear of gas stokers striking. If gas engineers were on good terms with the men, there need be no anxiety as to strikes. I remember the strike of gas men some fifteen or sixteen years ago in London, when the men at one works subscribed, and gave their manager a very fine gold albert chain and locket. They did not want to strike, because they had in him a man from whom they could get a kind word; and that is the sort of man required for managing gas-works. The manager to whom I refer has gone to his long rest. In him the men had a friend. His name was John Middleton, of the Wandsworth and Putney Gas Company. I know there are always black sheep in every flock; but, as managers, we must find them out, and then, when the opportunity comes, they must be sent away. I have had a good deal to do with men all my life; but I can do better with good words than harsh ones. I think in this all my readers will agree with me.

I notice that it was stated that as much as 11,497 cubic feet of gas has been made per ton of coal carbonized. I should like to know the illuminating power of the gas, and the proportion of cannel coal used per ton.

I should like to ask Mr. Smith, of Bolton (who said he put two tons of coal in each mouthpiece), if he will give the size of the retorts, and say how many hours this quantity took to burn off, as I am sure there are a great many managers would like to procure some of those retorts. I for one would.

I should very much like to see some of those engineers who spoke in the discussion in a small works, where they have about two men, to see what they would do. I am of the same opinion as Mr. Thomas—that it is of no use to talk of what a few works can do. I am making 10,500 cubic feet per ton, without any cannel coal; and this I consider is good for a small country gas-works. I have a gas-engine exhauster; and I think my results, produced without the use of the "iron man," will bear comparison with some of the large works.

As regards Mr. West's stoking machine, now that it has assumed an entirely different form I have no doubt it may be very good for large works; but I see by Mr. West's statement that the retorts must be of one size, or it would be of no use. I should think a gas engineer would be certain to look out for that, so as to have them all one size.

J. E. BUCKLE.

Gas-Works, Woodbridge, Suffolk, July 5, 1890.

Naphtha for Imparting Illuminating Power to Water Gas.

SIR,—In articles appearing in your JOURNAL on Stapp's (also on Van Steenberg's) water gas, it has been stated that the naphtha used for imparting illuminating power to the gas could be obtained at 4d. per gallon. The writer has recently tried to obtain naphtha at this price; but two Russian agents in London reply that they have no naphtha, crude or refined, at this price. Perhaps some one interested in the various processes for using this naphtha as a gas enricher may be able to state definitely, through the JOURNAL, what is the price.

June 28, 1890. ANXIOUS.

"Steam" Washers.

SIR,—Referring to the letter of Messrs. T. Fletcher and Co. in your issue of June 24, I beg to reply briefly that those who have seen the Greenall "Steam Washer" in use, will know that Messrs. Fletcher's theory "won't wash." The last time I saw the machine described as Fletcher's "patent" washer, was when it was tested against the Greenall steam washer at the exhibition of the Sanitary Institute of Great Britain at Leicester in 1885. After severe trials, extending over two days, the highest award of the Institute was given to the Greenall, while the Fletcher did not even receive mention. From this it would be assumed that the latter machine was the result of Messrs. Fletcher's theory.

I have not the assurance to ask you for a free advertisement of my various laundry apparatus (*vide* last sentence of Messrs. Fletcher's letter). It had the desired effect on me, and I consulted their list; but I am afraid a laundress would be at a loss to complete her work with their "whole apparatus."

Manchester, July 3, 1890. JOHN GREENALL.

Lead-Poisoning in the Wakefield District.—The Rural Sanitary Authority of Wakefield, on the recommendation of the Water Committee, have directed a letter to be written to the Wakefield Corporation, drawing their attention to the numerous cases of lead-poisoning in the Authority's district, alleged to arise from the action upon the lead service-pipes of the water supplied by the Corporation, and asking them to take into their serious consideration the advisability of treating the water by the addition of a small quantity of carbonate of lime, in the form of chalk, to harden it, before supplying the Authority.

Cookery Lectures in the Lake District.—A course of practical lectures in the art of cooking by the use of gas, given by Mrs. J. B. Thwaites, of Liverpool, has just been brought to a close at Windermere. The attendances throughout were fairly good; and the result has been a large number of fresh applications to the Gas Company for the "Eureka" stove of Messrs. John Wright and Co., Limited, the one which appears to best suit their consumers. On each occasion the Gas Company's Manager (Mr. J. B. Fenwick) was in attendance to give explanations as to the use of the stoves. At the close of the last lecture, Mr. E. W. T. Richmond, of Southport, Messrs. Wright's representative, delivered an interesting address.

The Brighton Electric Light Accident.—Our readers will remember that some months ago a watchman employed at a brewery at Brighton was one morning found lifeless on the premises; his death having resulted from a shock received from an electric light wire. The widow proceeded against the Brighton and Hove Electric Light Company, who supplied the brewery, for damages for herself and her six children; and she was awarded by the jury £800—£200 for herself, and the remainder for the children. A new trial was moved for on the ground that the amount was excessive; and the matter recently came before Justices Denman, Charles, and Vaughan Williams in the Queen's Bench Divisional Court. In support of the motion, it was stated that the deceased earned 22s. per week, of which 17s. went to support the family. The sum awarded was thus sufficient to purchase a life annuity for this amount; and it had been laid down in various cases that damages to such an extent would be excessive. After some discussion, it was arranged for the damages to be reduced to £500.

The Water-Works Purchase Question at Andover.—Last Friday week, a special meeting of the Andover Town Council was held, to consider the question of purchasing the Water Company's undertaking. The Town Clerk read the minutes of the Special Committee, who had engaged Mr. Lemon, of Southampton, to value the works, and report the result to the Council. A detailed report was presented by that gentleman, pointing out that the Corporation might start water-works of their own; but that the Company should be fairly treated, considering that they had supplied a public want for 14 or 16 years, which the Sanitary Authority had neglected to do. Having regard to the cost of their construction, and to the financial position of the Company, he valued the works at £7500; and the Committee recommended the Council to offer this amount to the Company for their works. A motion to this effect having been proposed, one of the Councillors contended that such an offer as £7500 was absurd; and he moved, as an amendment, that £8500 should be offered for the works. The amendment was, however, subsequently withdrawn; and the original proposition carried. The Town Clerk was instructed to communicate the result of the meeting to the Solicitor of the Company. The price asked by the Company for the works was £9500.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

During the past week the following progress was made:—

Bills read the first time: Airdrie and Coatbridge Water Bill; Sutton, Southcoates, and Drypool Gas Company (Electric Lighting) Bill.

Bills reported: Wallasey Local Board Bill; Walsall Corporation Bill.

Bills read the third time and passed: Gas Orders Confirmation Bill; Gas and Water Orders Confirmation Bill; Electric Lighting Acts Amendment (Scotland) Bill; Hyam and Hundred of Hoo Water Bill; Huddersfield Water Bill; Local Government Provisional Order (Gas) Bill.

Bills Royal Assented: Bury Corporation (Railway) Bill; Derby Corporation Bill; Electric Lighting Acts Amendment (Scotland) Bill; Falmouth Gas Bill; Local Government Provisional Order (Gas) Bill; Mid-Sussex Water Bill; Pontypool Gas and Water Bill; Portsmouth Water-Works Bill.

HOUSE OF COMMONS.

During the week the following progress was made:—

Bill read a second time: Electric Lighting Provisional Orders (No. 12) Bill.

Bills reported: Dewsbury and Heckmondwike Water-Works Bill; Metropolis Management and Building Acts (Amendment) Bill; Electric Lighting Provisional Orders (No. 6) Bill [Birkenhead, Great Yarmouth, Kingston-upon-Hull, Nottingham, Wigan, and York Orders confirmed]; Newcastle and Gateshead Water Bill.

Bills read the third time and passed; Airdrie and Coatbridge Water Bill; Sutton, Southcoates, and Drypool Gas (Electric Lighting) Bill.

The second reading of the Water Companies' Charges Bill, introduced by Mr. Causton on the 9th ult., has been fixed for Thursday next. The Examiners have been ordered to report on the Bill with respect to compliance with Standing Orders.

LEGAL INTELLIGENCE.

COURT OF SESSION—OUTER HOUSE.—Wednesday, June 18.

(*Before* LORD TRAYNER.)

Ovens and Son v. Bo'ness Gas Company.

In this action Thomas Ovens and Sons, chemical manufacturers, of Leith and Bo'ness, sued the Bo'ness Gas Company for £258 as the amount of damage which they sustained by an explosion of gas in the house of their Manager at Bo'ness on the morning of Nov. 29 last. It appeared that the gas escaped from the defendants' main, which it was averred was defectively laid. A plan was submitted which showed that there was a very slight curve on the roadway; and the evidence led by pursuers was in support of the contention that the turned and bored method of laying pipes, without lead packing at the joints, was unsuitable for a roadway upon which there was a curve. The Company contested this, and submitted evidence to the effect that turned and bored pipes might be laid, and had been laid, with safety upon much more acute curves than here. Among the witnesses were a number of practical men—including Mr. R. Mitchell, of Edinburgh, and Mr. J. M'Gilchrist, of Dumbarton. It was stated by the Chairman of the Gas Company that the pipe was laid in 1886. The old pipe was on the spigot and faucet system; and the Company, after inquiry into the best method, resolved, although it was more costly, that the new pipe should be laid on the turned and bored system. The result had been to reduce the leakage of gas from 22 per cent. to less than 12 per cent. Although there was a curve on the road, they used only straight pipes. They were laid at a depth of 20 inches, in forced soil, over mineral workings. The technical evidence was to the effect that straight pipes could be laid round a greater curve than the one in question without packing, that a subsidence of the ground would produce a draw no matter which system of laying was adopted, but that the escape would be more in the case of turned and bored pipes than in that of pipes laid on the spigot and faucet system. While admitting this, Mr. M'Gilchrist explained that to make too stiff a joint had been known to cause the pipe to break when there was a subsidence of the ground.

Lord TRAYNER, in giving judgment, said that according to the evidence before him the pipes were of the best sort, and of the kind now usually adopted by persons in the position of the defenders. The complaint that they were laid here along a curve did not seem to him to have any weight, because the whole of the pipes had remained with perfect safety and completeness since the day they were put down, four years ago, with the exception of this one joint, from which the gas escaped which led to the explosion. There was nothing defective in the pipes; and he thought there was nothing wrong with the way in which they were laid. The only question that remained was whether the defenders were bound to have packed the joints. That they had packed them since the accident, did not at all point to their being at fault in not packing them before. People were always wise after the event; and it was experience of this kind that led to improvements. But before the accident happened, there was nothing to suggest that it should have been done. The evidence amounted to this, that packing was not necessary, because the pipes were driven home; and they held their position without the necessity for the packing which was required in the case of the old-fashioned spigot and faucet pipes. It was said that defenders must be accountable for them. He thought they had accounted for them, because, when the street was opened, these pipes, which had been well and carefully laid, were found in perfect condition; no escape taking place except at one point. This showed that packing was not necessary on this curve, to prevent the gas leaking. This particular joint seemed to have been put a little out of position by the fact, as he gathered, of there having been some slight subsidence in the ground, which changed the position of the pipe immediately to the west of the joint which gave way; and this led to the escape of gas. He thought it was a very unfortunate accident; but the defenders were not to blame for it. Their Manager (Mr. J. King), the moment he had any reason to suspect an escape, from the shrinking of the gasholder, at once went to this place, thinking there might be a leakage in the chemical works; and just as he reached there, and before anything could be done, the explosion occurred. The defenders, as proprietors of these pipes, failed in no way in any duty which might have reasonably been expected of them to prevent accident by reason of an escape of gas. There was no other ground of liability stated; and therefore he must give absolviter with expenses.

NORWICH GUILDHALL—Friday, June 4.

(*Before the* DEPUTY-MAYOR *and a Bench of Magistrates.*)

Intimidating Gas Workmen.

To-day, *Osborne Green*, *Thomas Beck*, *John Burton*, and *John Scott* were summoned by Henry Hammond and John Edge for intimidating them with a view to compelling them to abstain from performing a contract of service with the British Gaslight Company. The proceedings were instituted under the Conspiracy Act of 1875. Green did not appear; the summons not having been served. The case against Beck was first proceeded with. Defendant, it appeared, was formerly in the Gas Company's employ; but some irritation having arisen, he was discharged, and the men who continued at work entered into an agreement with the Company to serve them for thirteen months at the current rate of wages, though no obstacle would be placed in the way of their leaving if they so desired, and gave the usual notice.* The Union men objected to these contracts. On the 6th ult., Hammond was in a public-house, when the defendant, Burton, and another man entered, and abused him; Beck at the same time threatening that he would knock his eye out. Since then the prosecutor had gone in bodily fear, as he had been again intimidated. Evidence was given that defendant was paid by the Company at the Bishop Bridge station on the evening in question; but this was declared to be false by Burton, who swore that Beck and himself were engaged at the Palace station on the 6th of June, and did not go near the public house mentioned by prosecutor. In connection with the charge against Burton, the intimidation occurred on the 27th ult., when he threatened that he would "make it right" for Hammond "when the nights get dark." In the case against Scott, it was stated that, on the previous Friday, the whole of the defendents met Edge at a public house, and called him by opprobrious names, and Scott caught hold of him and pushed him over. It was alleged that Edge was drunk, and that the fall was accidental; but this was strongly denied.

MR. REEVE appeared for the prosecution; Mr. Moss defended.

At the conclusion of the evidence,

The DEPUTY-MAYOR said the Magistrates were unanimously of opinion that a case of intimidation had been made out; and they had decided to convict. The maximum penalty was £20, or three months' hard labour; but while marking their sense of what was done, the Magistrates were desirous of inflicting the smallest penalty possible, in the hope that no further cases of the kind would occur. Beck would be fined 20s. and 10s. costs, or seven days in default of distress; Burton 20s. and 7s. costs, or seven days; and Scott, in whose case violence was used, 40s., and 11s. 6d. costs, or fourteen days. If any other cases of a similar kind came before them, they would, he added, probably be dealt with in a different way.

Scott paid the money, Burton was detained in custody, and in Beck's case a distress warrant was issued.

Reading Corporation Water Department.—The Water Committee have reported to the Reading Town Council that, after payment of all charges, there is a surplus profit on the working of the department during the half year ending Sept. 29 last of £1813, which sum has been placed to the credit of the general district account.

Serious Accident at the Rochdale Road Gas-Works of the Manchester Corporation.—Last Friday afternoon, while two men were working on a scaffold about 30 ft. high, at the Rochdale Road Gas-Works of the Manchester Corporation, one of the bearers on which the planks rested gave way, and both men fell to the flags beneath. One of them, John Tolam, received an injury to his spine, and his thigh and an arm were broken. The other man was not so severely injured.

Electric Lighting Works and Telephone and other Wires.—The Electric Lighting Provisional Orders Bill (No. 6) was before a Select Committee of the House of Commons last week on a point raised by the National Telephone Company in regard to the protection of their systems. The matter was argued on the Birkenhead Order; but the decision of the Committee will be regarded as the establishment of a precedent to be followed by the Board of Trade in all other Orders. The third subsection of clause 6 was the difficulty, and it was altered to read as follows: "The undertakers shall construct their mains and other works of all descriptions, and shall work their undertakings in all respects, so as not injuriously to affect the working of any existing electric circuits from time to time used or intended to be used for the purpose of telegraphic, telephonic, or electric signalling communication, or the currents in such circuits, and shall use every reasonable means, in the construction of their mains and other works of all descriptions and the working of their undertaking, to prevent injurious affection, whether by induction or otherwise, of any electric circuits used or intended to be used for the purposes aforesaid, whether existing at the time of the construction of such mains or other works or not, or the currents of such circuits."

* The form of agreement referred to here was given in the JOURNAL for the 17th ult

MISCELLANEOUS NEWS.

THE STRIKE OF GAS STOKERS AT LEEDS.

Disgraceful Scenes—Meetings of the Council—A Settlement Effected.

Early in the past week, the dispute between the gas workmen at Leeds and the Corporation Gas Committee developed to a degree of intensity not anticipated. The men actually concerned in the dispute were small in number when compared with those whom it was the unfortunate means of throwing out of work; the total number of the strike hands being about 400, of whom only 166 were gas stokers.

On Monday morning, although the notices of the men did not expire until the evening of that day, the line of action adopted by them brought about a crisis so far as regards many large consumers of gas. In manufactories and printing offices, gas-engines broke down; and in restaurants, gas cooking-stoves refused to act owing to the short supply of gas. It appears that there was ample supply of coal at the various works for the six o'clock shift to have gone on with; and had the men worked out the shift, there would have been a sufficiency of gas to supply all the people who use it as a motive power. The Committee therefore charge the inconvenience that arose to the refusal of the men to work out their notice. At the York Street station, the stokers proceeded as usual till Monday morning. The six o'clock shift went in, and, it is stated, did two draws; but after working for about two hours, they left in a body. The two o'clock shift did not put in an appearance; and the night men, who, it was believed, only intended to work till midnight, were not admitted. It was evidently expected that when the yardmen and wheelers left on the previous Wednesday night, these works would have to be closed immediately. But this expectation was not realized, because the Manager and the foremen themselves kept the stokers supplied with coal until the last shift left the works on Monday. A considerable number of men and women were collected in the vicinity of the entrance gates during the whole of the Monday; and, as at the other works, pickets were posted, but no disturbance occurred. Work at the New Wortley station ceased on Saturday week. The yardmen and coal-wheelers who were not under an obligation to give notice had struck work previously under circumstances recorded in our last issue; and inasmuch as the stokers would not wheel coal and perform the other duties that had been discharged by the men who had left, the making of gas could not be continued. Hence the unfortunate stoppage on the Saturday. The arrangements for lodging and provisioning the new hands, however, was busily carried on; and by Monday evening, all was in readiness for their arrival. The foremen, assisted by the Manager, were successful in keeping up the heats of the retorts; and abundance of coal was put into position for charging them as soon as the new men could be introduced into the works. At the Meadow Lane station, not a single man in the first two shifts returned to his duties on Monday. In respect to the night shift, who should have been prepared for work at 10 p.m., and whose notices would have expired at six o'clock on Tuesday morning, it came to the knowledge of the Gas Committee that they had resolved not to work after midnight, on the plea that the notices terminated at the end of the month of June; and as the men employed on the other shifts had not done any work during the day, it was decided that, if the men composing the nightshift presented themselves, they should not be admitted to the works. The men in this instance came forward, but were turned away from the gates by the police. At Meadow Lane some of the permanent buildings were fitted up for lodging the fresh hands, and a large marquee provided for the men's meals. Several vans laden with provisions were not so successful in evading the pickets; and although some managed to get inside the works, others were turned back, to await a more convenient season. In the early part of the evening, three tent erectors, who were making their way to the works for the purpose of putting up the marquee already referred to, were brutally treated, as was also an old man who was supposed to be an applicant for employment. Later on and after the police force had been strongly reinforced, the provisions and marquee were safely conveyed within the works.

About five o'clock on Tuesday morning the struggle reached its first acute stage. The Chief Constable (Mr. Webb) succeeded in getting the Manchester contingent of the new hands conveyed to the Town Hall; but pickets were placed there in order to keep a watch over their movements. It was supposed by the old hands that the new men from London were not to arrive on Tuesday morning at the Meadow Lane works, but this proved to be erroneous. Instead of the train in which they travelled drawing up at the Meadow Lane sidings, it ran right through to the Leeds Midland Station, and unloaded there. A little before this, at 4.30 a.m., a force of about 200 police, with 12 mounted constables in front, had drawn up outside the station. They were under the command of the Chief Constable and superintendents. The men were at once marshalled in rows, and the protecting force having compassed them, a start was made for the works. The vicinity of the gas-works was comparatively clear at the time; but as the party neared, the tramp of horses and men made it very evident to the watchers that a large body was approaching, and as many of the pickets as could be summoned were drawn up in a compact body. The object of the latter, who could not hope to vanquish their opponents, was, if possible, so to disorganize them as to prevent the men getting into the works. As the escorting body approached the other, they were greeted with howling and abusive epithets. The formidable sticks, many of them with hooks, spikes, and nails attached, with which the gas workers and others were armed, gave promise of the sterner game that was to follow. The first attack was made by the crowd, who succeeded in breaking the front rank of the police; but their triumph was short lived, for the police at once drew their batons and charged. The fight only lasted a very few minutes; but those who took part in it aver that there must have been a large number of heads broken or bruised. The police soon cleared the crowd, and marched the new hands in at the gas-works gates. As soon as the imported hands were got inside, they were regaled with food; but it is asserted that almost immediately afterwards a number of them began to clamour for money, and to be allowed to go free. After eight o'clock crowds of people began to assemble in Meadow Lane, and early in the afternoon that thoroughfare was completely blocked, the traffic having to be diverted. The scene was a lively one, but no further disturbance of a serious nature took place in this locality. The strikers, however, were not idle. Whenever possible, they clambered on to the walls, and appealed to the "strangers" to come out; and their efforts were attended by no small measure of success, for early in the afternoon fifty of the new hands came out, and later additions brought the number up to between seventy and eighty, leaving only about fifty men in the works. Those who left the works were marched up to the Town Hall Square, where a mass meeting was held. They stated as their reason for leaving that they had been taken to Leeds on false pretences, both as regards the circumstances and the conditions promised. A deputation waited on the Gas Committee at the Municipal Buildings later, and asked that they should be allowed their fare back to London; but this was absolutely declined. The fact that about fifty of the newly-engaged hands remained inside the works, seemed to cause much annoyance to the strikers. Encouraged, probably, by the success of their efforts at New Wortley (referred to hereafter), a large number of men gathered in the neighbourhood of the works in the evening; and shortly after ten o'clock they made a determined attack upon the gates, with the evident intention of forcing the "blacklegs" to leave. About thirty policemen were on duty inside the gates; and they were assailed with bricks and stones, and the lamps were smashed. In order to disperse the rioters, the police proceeded outside, and a furious attack was made upon them with stout sticks, as well as stones and bricks. The police freely used their batons; and for a short time the fight assumed a very serious aspect. Assistance was telegraphed for to the Town Hall; and after its arrival, the rioters were compelled to retire. Several of the police suffered severely in the *mêlée*; and some of their opponents were likewise considerably injured.

The most disgraceful scenes on Tuesday were witnessed in the vicinity of the New Wortley works; owing, from all appearances, to a blunder on the part of the authorities. It was well known that an effort was to be made to bring the men who had been lodged during the night in the Town Hall to this station. The police to form the escort were ordered to parade at the Town Hall at four o'clock; and it was understood that as soon as the military expected from York arrived, a procession would at once be formed. Those in charge of the works were quite prepared to receive them. A large copper was boiling in the yard; tables with seats were ranged along both sides of one of the retort-houses, and huge piles of sandwiches stood ready for the meal which Mr. Smith, the Manager, intended to give the men. This time was very opportune for the passage of the men, as all the industrial establishments were then working. A public notice was issued a little later, advising all persons who had assembled to disperse themselves in a peaceable manner; warning them of the serious consequences of assembling in any violent, turbulent, and threatening manner; requesting the co-operation of the public with the police authorities in maintaining peace; and announcing the determination of the authorities to do all in their power to prevent any unlawful assemblies calculated to inspire fear in the minds of the peaceable inhabitants. Notwithstanding this notice, after the various manufactories closed, something like 10,000 persons had congregated in the neighbourhood of the New Wortley works. It was not until a few minutes before eight o'clock that it became known for certain that the long looked-for procession was on its way; and then the railway bridges that cross Wellington Road, just beside the gas-works, were thronged with men and women with huge stones ready to throw at the procession as it passed beneath them. It was here that the most mischief was done. The way in which the procession would be at the mercy of persons in such a position, never seems to have occurred to those responsible for its safe passage; or, if the danger was apparent, they were unable to cope with it. Up to that point no great violence seems to have been offered. The railway arches were reached a few minutes after eight o'clock; and, on arrival there, cavalry, constables, and workmen alike were barbarously treated. The people overhead threw huge stones down upon the men as they passed; and it was then unfortunately too late to clear the bridges. The procession was entirely at the mercy of those above, and suffered accordingly. One police superintendent was so badly hurt that he was obliged to receive the support of two officers to struggle through the crowd until the gas-works were reached. This was accomplished amid the groans and hooting of thousands of people. Hedged in on every side by dragoons and police, both mounted and on foot, the men, or at least the chief portion of them, were led to the Golderd Street entrance. The dragoons there formed guard until the gates were opened. On this being done, the "blacklegs" rushed into the yard. So great was the scrimmage, that it was impossible to effect the entry of the whole of the men at once; and the fact that a second effort had to be made, considerably aggravated the state of affairs. This was done at the Wellington Road entrance; and the rush in of the remainder of the men was the sign for another tremendous howl. The whole of the imported men once in the works, the wounded were taken in, and attended to. Nearly all the new men bore unmistakable signs of rough usage; and they complained bitterly of the way they had been treated. The bridges whence they had been so savagely assaulted ought to have been cleared; and altogether greater firmness should have been displayed on the part of the authorities. The police force, in their opinion, was totally unfit to cope with such an emergency as it had been their lot to go through. It was soon apparent that the men had regretted their bargain, or had under-estimated the difficulties of the situation. Oblivious of all that had been done for their welfare, it was not long before detachments of them were to be seen grouped in different parts of the yard discussing the day's proceedings, and the dangers they would run in staying after the hostile display of public feeling they had witnessed; and they did not by any means appear to be willing to settle down to work. About nine o'clock, a section of the men scaled the walls; and they were greeted with cheers from outside. In view of such encouragement, the first few had the satisfaction of seeing their action imitated by a very large number of the other new hands; and by ten o'clock quite one-half of them had left the place.

Matters were very quiet at the York Street works, as it was well-known that the efforts of the Gas Committee were to be directed

towards the Meadow Lane and New Wortley works. There were a few police officers about the works; but their services, happily, were not required. The gas stokers connected with the night shift presented themselves at the works at ten o'clock on Monday night, and remained at duty till six o'clock the next morning, when their notices expired. The Manager (Mr. Townsley) and the men have always been on very good terms; and on that gentleman informing them on Monday night that, if they began the shift he would expect them to work right through, they readily consented. Thus during the night there was not the slightest disturbance, and in the morning the men left the works quietly. On Tuesday evening at these works one holder was full, and another about one-fourth. For the daily consumption of the town 2½ million cubic feet of gas are required; and at this station there was about one-half of that quantity.

A great number of persons, as will have been gathered, were injured on Tuesday during the riots by stones, the batons of the police, and in other ways. Several were treated by local medical men; and about thirty persons were admitted to the Infirmary suffering chiefly from scalp wounds and severe cuts. As to the supply of gas, the machinery at many industrial establishments could not be operated; and, when darkness set in, little or no gas was obtainable for lighting, while in the public thoroughfares the lamps were not lit at all. The same evening meetings were held. At one of them the action of the Gas Committee, in bringing the military into the district, was condemned; at another the Gas Committee were found guilty of an error of judgment in allowing the dispute to assume such a serious aspect; and at a third, those assembled, while recognizing the sincerity of the Committee in desiring to serve the ratepayers, believed that "they would be more in accordance with the public opinion of the town, and serve its interests better by a judicious course of conciliation, than by the coercive policy hitherto pursued."

Intense excitement prevailed in the borough on Wednesday; and on all sides the proceedings of the previous day was the one topic of discussion, and there was a disposition on the part of the ratepayers generally to censure those in authority for the disgraceful muddle which was made, and which led to the injury of so many men. The strikers were very jubilant over what they regarded as their victory; and over the fact that they had induced the bulk of the new men to leave the works. Not until Wednesday could the seriousness of the attack from the railway bridge be gauged. It was simply marvellous that more people were not injured, considering the number and nature of the missiles that were thrown down at the procession. Parts of sleepers, railway chairs, bricks, coal, coke, stones—anything that came to hand—were hurled at the struggling mass below. As the result of so dangerous a shower, many men were felled to the ground, and hats and broken helmets were sent flying in all directions. There is reason to believe that comparatively few of the actual aggressors felt the weight of the police charge that was made, and that the majority of the sufferers were innocent spectators. Two of the rioters—named Armitage and Greaves—were charged at the Town Hall on Wednesday with having thrown stones at the police on the previous evening; and they were remanded for a week, bail being refused. During the rioting, an attack was made upon the Chairman of the Gas Committee (Alderman Gilston) by the crowd; and this led to the adoption of measures for his protection. He not only had a police escort to conduct him to his residence at Hunslet on Tuesday evening, but a detective remained in his house overnight; and he was similarly guarded the whole of Wednesday.

The first real attempt at bringing the dispute to a peaceful termination was made on Wednesday; the initiative being taken by Mr. W. Beckworth (the President of the Chamber of Commerce) and Mr. T. W. Harding. The Sub-Committee of the Corporation Gas Committee held a protracted meeting that day, in the course of which these two gentlemen waited upon them, and offered their services in assisting to bring about a settlement of the dispute by means of arbitration. The Committee had already been considering the question, and readily fell in with the suggestion made. The Union Committee, who had previously been interviewed, had expressed their willingness to discuss matters with the Gas Committee. A conference was held during the afternoon, in the Board-room of the Chamber of Commerce; and in addition to the Gas Sub-Committee and the representatives of the men, Messrs. Beckworth and Harding were present. The proceedings were conducted in private, and lasted two and a half hours. The Secretary of the local branch of the Union (Mr. Cockayne) acted as spokesman for the men; and it is stated that there was a free discussion of the different questions which were involved, and it was conducted in a temperate manner. Unhappily, however, the result thus far was simply to ascertain the exact position of both sides. In order, therefore, to give the men an opportunity of consulting with their body, and to give the Gas Committee further time to consider their position, the conference was adjourned till Thursday morning.

No disturbances occurred at either of the gas-works up to Wednesday evening. The pickets continued on the watch, and there was still a considerable force of policemen in attendance at each place; but nothing of a disorderly nature occurred. At night, however, matters did not proceed so smoothly. A very large crowd assembled around the Meadow Lane works; and two attempts were made to force the gates. The worst affray took place at the Kidacre Road entrance. The outer gate consists of two parts, and one of these the mob succeeded in wrenching off. The police charged, and though met by a hail of stones, succeeded in driving back the crowd and clearing the street. At eleven o'clock the crowd had much decreased, and were standing about awaiting events. There was an idea afloat that the Gas Committee meditated the introduction of 150 new men into the works during the night; and the men were apparently content to wait till the attempt should be made. The New Wortley works presented a busy appearance the whole of Wednesday. Of the 300 men who had been escorted thither from the Town Hall, only about 70 remained. Part of these started work at ten o'clock on Tuesday night. The Manager (Mr. Smith) had prudently offered them pay at the rate of time-and-a-half; and he was very well pleased with the manner in which the men performed their duties. Many of them were experienced stokers; and the result of their united efforts was to be seen in the position of the gasholders. All that seemed to be needed was to convince the workmen that adequate measures were being taken to afford them protection. During Wednesday the assemblies in the streets were comparatively small; but, as was expected, they rapidly swelled soon after the industrial establishments in the neighbourhood ceased work. Then several times the crowd came in contact with the police, with the result that a few arrests were made, and two or three persons injured. At one time the state of things was such as to make the police apprehensive that they would not be able to cope with the crowd; and a message was sent to the Town Hall, asking for reinforcements. The request was promptly met. In a short time fifty more constables arrived to recruit the ranks, which had previously numbered about a hundred; and later on a detachment of Carabineers put in an appearance. There was, however, no immediate need for them; but their presence had a salutary effect upon those who were disposed to create a disturbance in the streets. They stayed the whole night at the works; and this considerably allayed the fears of the new hands. On the message sent by the police at New Wortley for reinforcements being received at headquarters, the Mayor (Mr. Alderman Emsley) was informed of the state of affairs; and, accompanied by the Town Clerk (Sir George Morrison), and the Magistrates' Clerk (Mr. J. Thornton) he went to the works in a cab. The conveyance, after it had passed over Wellington Bridge, was stoned; and the cabman, afraid to face the storm, turned his horse round and drove back. He had not gone far, however, when the Carabineers were met; and with such an escort, it was not difficult to persuade him to turn once more. On reaching the scene of the disturbance, his Worship read the Riot Act. The cabman and also the Mayor's attendant were struck with stones in the first attempt to reach the scene of the disorder, but they were not badly injured. After this the mob gradually dwindled down to small proportions.

The men who made their escape by climbing over the walls of the New Wortley works on Tuesday night, were lodged in the rooms of the Gas Workers' Union; and on Wednesday, together with a few who had left the Meadow Lane works, were sent, at the expense of the Union, to their respective homes in Manchester, London, Bradford, and York. Before leaving the Union rooms they were addressed by Mr. W. Thorne, the General Secretary of the Union.

With regard to the gas supply, on Wednesday there was only a small quantity of gas in store at the Meadow Lane works; and at the New Wortley station a somewhat similar state of things was reported, though there the Manager not only had upon his mind the responsibility of supplying gas, but was put to the additional inconvenience of having his private house turned into a hospital. At all the works, the permanent officials were much overtaxed in the way of labour; as, in order to maintain the heats, it was necessary for managers and foremen alike, by day and by night, to shovel fuel into the furnaces. Little complaint was heard from the private consumers of gas in the town; and this was probably chiefly due to the fact that the want of gas is little felt at this season of the year. But with regard to those who consume gas for manufacturing purposes, it was quite another matter. Wherever gas power was employed in manufacture, work was, of course, completely stopped; and it is computed that some 20,000 people were out of work in consequence.

There was a special meeting of the County Council on Wednesday, when Alderman Gilston, in moving the approval of the proceedings of the Gas Committee, made a brief statement in regard to the dispute. He said that all he had done had been in discharge of what he believed to be a public duty. That morning Mr. Beckworth and Mr. Harding, the President and Vice-President of the Chamber of Commerce, waited upon the Gas Committee to say that the representatives of the men were not indisposed to meet the Gas Committee. This was the first intimation the Committee had that the men were willing to meet them. A meeting was arranged to be held that afternoon; and he hoped their deliberations would result in good. They had come to the conclusion that it would be well the men should have further time to fully consider the rules; and the conference would be resumed on Thursday, for the purpose of trying finally to settle the matter. He hoped himself that this might be the result. He did not want to say anything more just at present, lest he might state something that would lead to a discussion, which, instead of healing, might widen the breach. This being the case, he thought, under the circumstances, the best thing he could do would be to move the confirmation of the minutes. He might, however, observe that the Gas Committee, before Messrs. Beckworth and Harding called upon them, had been considering a resolution to submit to the Council to the following effect: "That the Chairman be requested to state in the meeting of the Council to-day that the Committee are prepared to submit the differences between the gasmen and the Committee to a Board of Conciliation, and that in the meantime the men engaged at the works be afforded ample protection." The Committee from the beginning had been disposed for arbitration and conciliation. So far as he was personally concerned in this matter, before the notice to the men was given, he wrote to the Chamber of Commerce, asking if this was not a proper subject for the new Board of Conciliation to begin their operations with. He was given to understand by the President that they were not organized for that purpose as yet; and he thought, under the circumstances, it was hardly likely that an arrangement on these lines could be made. The Committee had been disposed from the commencement to consider and formulate a number of rules that should be agreeable to the men and to themselves, and that should not only be agreeable to all parties concerned but also binding. They as a Committee had been held up to the public as being designing and self-seeking men; but they were prepared to bear the whole responsibility. They felt the gravity of the position, and were not prepared to shirk it, or shrink from it—seeking justice both for the men and for the masters in this matter. Mr. Gordon then desired to move as an amendment—"That the Council approve of the proceedings of the Gas Committee, except so far as they relate to the proceedings of the Special Sub-Committee, appointed on June 16; but deeply regret the arbitrary manner in which this Sub-Committee has carried on its relations with the Leeds gas stokers, and expresses its entire disapproval of their actions up to noon-day." After a discussion between the Mayor, the Town Clerk, and Mr. Gordon, the amendment was ruled out of order. A resolution was next moved by Mr. Gordon disapproving of

the appointment of the Sub-Committee. He pointed out that this matter had its origin before the Sub-Committee was appointed, when time after time, year after year, the Gas Committee continued to sell gas in Leeds at a smaller price than it was costing them to make it. One of the arguments by which the Committee had been met by the men was this: That the price of gas in Leeds was raised 4d. per 1000 cubic feet last October, while the wages of the men, to which the rules related, were only raised to the extent of 2d. per 1000 cubic feet; and it was asked why, when the Committee were actually obtaining a profit by raising the price, they should proceed to alter the rules so as to reduce the wages of the men. Now, if the Committee had not been selling gas at a price less than it cost to make, they would not have been met by that argument. There was something to be said for the Sub-Committee, because he had not the slightest doubt in his own mind that the men extorted from the Gas Committee in October more wages than they were strictly entitled to. As the men chose the best time of the year for attacking the Committee, he did not see that the latter showed bad policy in choosing the best time of the year for attacking the men. But when he had said that, he had uttered the last word of approval of the Committee's proceedings, because the method which they employed was bad; and they had shown such a want of diplomacy and tact as to be, in his opinion, a disgrace to the body to which they belonged. The motion was not seconded; but a proposition was made that the whole subject should then be considered. This was seconded; but an amendment adjourning the meeting to Thursday was ultimately carried.

Considerable excitement still prevailed on Thursday; but the authorities had less cause to apprehend any serious renewal of the disturbances which marked the two previous days. Nevertheless they did not relax, but rather strengthened, their arrangements for preserving order in the streets, and for protecting the new stokers. At an early hour a detachment of the 10th Hussars arrived in the borough, and paraded in the afternoon at the Town Hall, ready for any service which might be required of them. Considerable bodies of police continued in charge of the works; and towards the evening detachments of the Carabineers joined them. Beyond keeping the streets in the vicinity of the works clear, neither the police nor the military had much to do. As to the working of the new hands, they discharged their duties with as much energy as could be expected from men who had passed such a trying time. At the New Wortley works on Thursday there were in all 115 men, as some of those who, in a panic, left the works on Tuesday succeeded in returning, despite the watchfulness of the pickets. The imported men on being engaged signed agreements for longer or shorter periods—in some instances, it is said, for twelve months. It has been stated that the new hands were not aware, when they agreed to come to Leeds, that there was a dispute; but some of the New Wortley men have admitted that they were not unacquainted with the state of affairs—in fact, that they were informed by those who engaged them that there was a strike impending, and also what were the terms which the old hands had rejected. A considerable proportion of these men had been employed at the Manchester Corporation Gas-Works, but had lost their work through the strike which took place there last winter. The number of retorts which were kept going at New Wortley during the trouble last week was 252; and the quantity of gas in stock on Thursday evening was 330,000 cubic feet. At the Meadow Lane works everything was quiet on Thursday, although large numbers of people gathered about the approaches. The 40 men in the place continued to work in regular shifts; and about 120 retorts were kept charged. Including these, there are 380 retorts ready for charging. The gas making proceeded steadily, and, considering the number of men employed, at a satisfactory rate. Of the three holders supplied from these works, one was full on Thursday evening; another, half-full; and the largest, about one-third full. That considerable progress was being made in the production of gas at both the New Wortley and Meadow Lane works was very apparent. There was a material improvement in the lighting of the streets, and in the supply of gas to private houses. There were further cases before the Magistrates on Thursday in connection with the rioting during the previous two days; and the prisoners were remanded till to-morrow.

The adjourned conference was resumed between the Gas Sub-Committee of the Corporation and the representatives of the gas workmen on Thursday morning. The two bodies met at first in different rooms at the Chamber of Commerce, and were alternately interviewed by Mr. Beckworth and Mr. Harding, who, acting as intermediaries, conveyed the various propositions from one body to the other, and these were discussed separately. Subsequently, the members of the Gas Committee joined the representatives of the men; and after discussion the latter agreed to terms of settlement subject to the approval of the general body of the workmen. As to the second rule, under which it was proposed to do away with firemen, that was retained as it was granted in October, with this exception that, whereas the men now carbonize 55 cwt. of coal per shift, they agreed to carbonize 60 cwt. This was the only concession made by the men with regard to work. The clause requiring the men to enter into a four months' agreement during the winter months, was withdrawn, and the men agreed to give or take twenty-eight days' notice at any time. As to the concession of a week's holiday without loss of wages, granted in October last, and which only applied to about one-fourth of the total number of employees, the men consented to that rule being struck out; and in its place the Gas Committee agreed to give double pay for all shifts working on Christmas Day, Good Friday, Whit-Monday, and the August Bank Holiday, and single pay for any men who do not work on those holidays. The men promised to recommend their fellow-workmen to accept the conditions which were thus mutually agreed upon, and the Gas Sub-Committee also agreed unanimously to recommend the Gas Committee to do the same. It was pointed out, however, by the men, that no terms could be accepted which did not make provision for the reinstatement of the whole of the locked-out workmen, and the withdrawal from the gas-works of the new hands. The Sub-Committee could not see their way to agree to this condition without consultation with the General Committee, which was to meet in the afternoon, and an adjournment took place. Immediately after the conference, a crowded meeting of the strikers was held at the rooms of the Union. Mr. Thorne presided, and explained to the men the propositions; advising them to consider them thoroughly before coming to any decision, as they must have no grumbling afterwards. Mr. Tom Mann, Mr. Cockayne, Mr. Pollard, and Mr. Paylor afterwards addressed the meeting; and on a vote being taken, it was unanimously decided to accept the terms proposed, subject to an arrangement being made with the Gas Committee for the removal from the works of the whole of the "blacklegs." The conference was resumed at two o'clock; and it was announced that the men had accepted the terms offered, but that they insisted on the removal of the imported men. Shortly before three o'clock the members of the Sub-Committee left the conference to ascertain the feeling of the General Committee upon the subject. On their return to the Chamber of Commerce, they announced that the Gas Committee had unanimously decided to accept the terms which had been agreed upon between the Gas Sub-Committee and the men's representatives, with the exception of the matter referring to the removal of the "blacklegs" from the works. This matter the Gas Committee left for the consideration of the Council; and that body, as will be seen below, agreed to the demand of the locked-out men, and left it to the Gas Committee to make arrangements with the new men to leave the works.

As was agreed on the previous day, the Council assembled again on Thursday afternoon. The Mayor presided. Alderman Gilston, on rising to make his statement regarding the negotiations between the Gas Sub-Committee and the men, was greeted with a storm of hisses, principally from the gallery, and cries of "Order" from the members. Referring to the conference which had taken place in the morning, he said they had considered *seriatim* the whole of the new rules which were introduced to take effect on July 1; and he was glad to say that they had come to an arrangement or understanding which, he thought, would be satisfactory and honourable to both parties. No doubt it would be said that if they had done this in the beginning, a great amount of trouble, a great amount of public disturbance, and much injury to person and property in the borough, would have been avoided; but the Committee, in the discharge of their duty, had done their best. They sought from the beginning to bring about an understanding by mutual concession. The Council and the people of the borough at large were much indebted to Mr. Beckworth and Colonel Harding for the part they had taken in this matter. Proceeding to explain the position of the question, he said that in December of last year he received a letter from the Secretary of the men asking if the Committee intended to provide a code of rules, or if the Committee of the workmen should draft them themselves. In reply, they told the men that in due course this matter would be considered by the Committee; and new rules would be forthcoming. The new rules were drawn up; and they invited the opinion of the men upon them. No opinion was given to them; and they were forced, in consequence of this silence, to take the steps they had taken to prevent the town, he might say, being in darkness. They gave the men notice; and they tried to fill their places. They engaged the men; but the forces of law and order were hardly equal to defending the rights of the citizens of the town. He regretted it much; and was disappointed. They had to fill the places of these men; and they had done it to a considerable extent. They had any number of men, who were able and willing to come and make gas and keep the town from darkness; and he was glad to say that they had now the necessary forces to protect these men. But although they knew that they were in this position, and that they had got over the worst of the turmoil and strife, a knowledge of that power made them conscious that concession in this matter was no dishonour. Therefore they met the men that morning, conscious that if the worst came to the worst, the greatest troubles had passed. He must say the men met the Committee in the most conciliatory spirit. Under the new rules the Committee wished that the men should enter into an agreement to work from October to January, so that the town in the winter might not be plunged in darkness. They put in this rule for the protection of the people, and, he might say, their industries from loss and inconvenience in the winter season. They discussed this matter fully and fairly, and the men ultimately agreed that instead of giving 14 days' notice, they would give 28 days' notice; and that the Committee's rule, so far as giving the men notice when they were letting down retorts, should remain as at present—viz., 14 days. The next matter discussed was the question of holidays. Previously the men had been given Christmas Day and Good Friday as holidays; single time being allowed if they were not working, and double time if they were required to work. The men, in their conditions last October, insisted upon a week's holiday and a week's pay. The Committee thought that this was an unusual thing in the industries of the town; and they went into the matter with a desire to meet the men if possible. It was suggested that in addition to Christmas Day and Good Friday the arrangement might be extended to Whit-Monday and the Bank Holiday in August—that was four days in the year, instead of the eight that were required by the men. They mutually agreed upon that. Then came the question as to stokers, firemen, and coal wheelers. Up to the present time, the stokers had been charging 55 cwt. of coal per shift of eight hours. He might say that, under the new rule, a man was to fire or charge 55 cwt. of coal in the eight hours, attend to three fires, and they would relieve him of the wheeling out of the coke and ashes, which meant about twenty barrowloads in the eight hours. This the men objected to; but they said that to satisfy the Committee on that point, they would increase the quantity of coal that they would carbonize from 55 cwt. to 60 cwt. per man per shift, that the firemen would attend to the fires to carbonize the additional amount, and that the coal wheelers would bring in an additional 5 cwt. to what they were doing now. This, he took it, would mean a reduction of the cost of carbonizing coal of somewhere between 9 and 12½ or 14 per cent. The Committee considered this a satisfactory arrangement. If there was nothing else in the way, the men might take their places in the works that night, or at any hour at which they required their services; but he was sorry to say there was a difficulty. That difficulty was one that the Gas Committee would hardly take it upon themselves to determine; and they thought it best that the Council, as a body, should take upon themselves the responsibility of that act. At that moment they had a number of men in their employment, who had been engaged for three months and longer periods. They had been engaged at a difficult time, and they had risked much

during the past few days of their service. These men had rendered some service to the town; and the Gas Committee felt that as honourable men they must deal honourably with them. The condition laid down by the old men was that the new ones should leave their employment before they again started work. It was suggested by some that there were two ways of getting out of the difficulty, and one was that inasmuch as they had three gas-works, the whole of the men now in their employment might be transferred to one of them, and that the old servants might take their places in the other works, and that both sets of men should work upon the same terms and conditions. He would not give up the new men otherwise than by means that were honourable and satisfactory to them and to him. If the Council wished it, he would go to the gas-works, when it would be safe for him to do so, and would try to make an honourable arrangement with the men; but he would not be a party to make conditions that were not honourable to themselves and satisfactory to the men who had served them at this time. He hoped that when the public knew better why the Gas Committee had worked, when they knew better their object and their undertaking, they would not hustle them in the street; but would say: "You may have erred, but we will say this on your behalf—even through slander and through danger, we believe that you did what you deemed to be best for the public interest at the time you did it." Mr. Wilson said no one could have read what had been reported in the papers during the last few days without feeling they had passed through a most serious crisis; and unless care were now taken, the result might be felt in the town for many weeks and months to come. It certainly seemed to him there had been serious misunderstanding between the men and the Committee. What, however, the Council were at present concerned with was how to get over the difficulty as completely as possible, and with as little likelihood of friction hereafter. He thought they should let the imported men go, and compensate them. There were two courses open to the Council—to retain the men, and to let them go; and was there anyone who would say that to retain the men would be advisable in the present state of affairs? Mr. Lister asked if it were true that some of the men were engaged for twelve months. Alderman Gilston replied that some of the men were engaged for three months, a considerable number for six months, and some for twelve months. Mr. Batley supported Mr. Wilson's proposition; while Sir Edwin Gaunt did not think they should talk of compensation. The men could not, he argued, be compensated; but they could have their salaries paid for what they were engaged for. Mr. Hardwick regarded the suggestion as to compensation as a good and wise one; and, while speaking, took the opportunity to correct the rumour that the new hands went to Leeds without being informed of the dispute. Mr. Gordon moved—"That the Council confirm the terms of settlement with the gas stokers indicated by Alderman Gilston, and approve the appointment of a Committee to arrange terms with the imported men." If they took the men in the works at 140, their average wages at 26s. a week, and the average probable term of employment at about six months, they would find they would arrive at a total little short of £5000. But terms very much lighter than those could be arranged; and he believed a fair bargain could be made with the men. Mr. Laycock seconded the motion. Alderman Spark approved of the motion. He had confidence that the Committee would be able, with the help of the men who were coming back to their employ, to settle this question with the imported men in an amicable way. The Union men themselves had sent away some 300 or 400 of the new hands. Mr. Harland said that, although Alderman Gilston had asserted that the Committee from the first had been ready for conciliation, there had been no evidence of it. Alderman Ward supported the resolution, on the understanding that the Committee Mr. Gordon had in view was the Gas Committee. As a member of the Sub-Committee, upon which some members of the Council were disposed to cast a certain amount of reflection, he knew something of the tension and anxiety which had attended their labours during the past week; and he also knew something of the difficulties they had had to contend with. No step in this great crisis had been taken without consulting the Gas Committee. Alderman Gilston hoped that, in settling the question, it would be referred to the Gas Committee, as that was the proper course to take. Mr. Gordon objected to altering the resolution, although he had not the slightest objection to the Gas Committee undertaking to carry it out. The resolution was then adopted unanimously. Mr. Gordon next moved, to show that he had no feeling in the matter, that the question be referred to the Gas Committee. Sir E. Gaunt seconded the resolution, which was carried. A discussion afterwards arose as to the adjourned debate on the Gas Committee's action with regard to the dispute; and it was agreed that this should be postponed until the next Council meeting—to be held on Thursday next.

On Friday morning the Gas Committee met at the Municipal Buildings, when a resolution was passed, authorizing the Sub-Committee to go to New Wortley and Meadow Lane works, and make terms with the imported men, and inviting Mr. Beckworth and Colonel Harding, who had taken part in the negotiations with the locked-out hands, to accompany them. The Sub-Committee first visited the Meadow Lane works to ascertain what terms could be made with the imported men. Mr. Beckworth and Colonel Harding both addressed them, informing them of the whole of the circumstances, and explaining the feeling of the Corporation with regard to them. The men were first asked what would be satisfactory to them in the way of settlement. They were unanimous in the opinion that it was undesirable for them to continue at work there if the old hands were to come in; but on the question of the amount of compensation, they were entitled to for giving up their work, they were somewhat divided. The Committee stated that they were prepared to offer the following terms: Men who did not sign any agreement to receive £2 10s.; men who had signed for three months to receive £5; and men who had signed for twelve months to receive £7 12s. In addition to this, the men were to receive their full wages for the work they had done; and the Committee were to pay their railway fares to the places from whence they came. There were no six or nine months' agreements. The men considered these terms very satisfactory, and agreed to them. The Committee then proceeded to the New Wortley works, where the men were asked if they were prepared to accept the terms which had been agreed to by the Meadow Lane hands. There seemed to be a feeling among them that they should receive about six months' wages, which would be meeting the Committee half-way; and a certain proportion of them expressed the opinion that the offer and acceptance of a ten-pound note would settle the whole matter. It will thus be seen that the terms offered on behalf of the Committee fell short of the men's anticipations; but they were evidently not unwilling to get out of the situation, and the offer of the deputation was therefore accepted with a readiness which showed that after all they were perfectly satisfied. The men were advised by both Colonel Harding and Mr. Beckworth to leave the town as quickly and quietly as possible; and Alderman Gilston afterwards entered the refreshment-tent where the negotiations had been conducted, and addressed them. He thanked them for all they had gone through on behalf of the Corporation, expressed regret that they had had to endure so much, and urged on them to make a good use of their money. The men intimated that they hoped measures would be adopted to give them a safe passage to the railway station, and this was promised them.

The Gas Committee again met in the Council Chamber in the afternoon, when the result of the interview with the imported men was reported; and the arrangements made by the Committee unanimously ratified. It was determined to draft the men away from the works as speedily as possible, and to get the old hands to recommence work at six o'clock, if matters could be so arranged. Members of the Committee then drove off to the respective works to pay the men their wages and compensation money. The total amount of compensation paid was £810, of which £295 went to the hands employed at Meadow Lane. This, of course, is irrespective of wages and railway fares.

The imported men were conveyed to the railway stations in waggonettes, thoughtfully provided by Alderman Gilston; and shortly after five o'clock, they had nearly all quitted the town. At both the New Wortley and Meadow Lane works, full shifts of the old men turned in at six and ten o'clock in the evening; and the work proceeded satisfactorily. The police were withdrawn from both places; and the whole of the extra police called into the borough returned to their respective head-quarters.

Regarding the gas supply on Friday, it was fairly good up to nearly midnight, when the streets were once more in darkness. Work was resumed in the morning at some of the manufacturing establishments which had been stopped on account of the failure of gas-engines; but in the afternoon, the pressure was not sufficient to keep them operating. This arose, however, from the fact that as the quantity of gas in the holders was getting low, it was deemed advisable to economize it, in order to give as good a supply as possible on Saturday night.

The New Wortley and Meadow Lane gas-works were in full working order on Saturday, and up to the time of going to press, the production of gas was being proceeded with as though there had not been the least disturbance in the manufacture. A gigantic meeting in celebration of the success of the men was held on Hunslet Moor on Sunday afternoon, when fully 30,000 people gathered and endorsed the condemnation passed on the Gas Committee. Mr. W. Thorne, the General Secretary of the Gas Workers' Union, proposed a vote of thanks to the "Press and to the workpeople of the various trades, who, at great risk to themselves, boldly came forth in defence of the gas workers." He remarked that the Corporation had put its hands in the fire, and had got severely burnt. He did not, however, condemn the Leeds Corporation so much as the gas engineers in all parts of the country who had prompted the Corporation, and who had entered into an organized conspiracy to crush the Union out of existence. The motion was seconded by Mr. Paylor, and carried amid great cheering. In the course of the proceedings, a telegram was read from the Metropolitan delegates of the Union conveying thanks to the men "for the gallant battle so nobly fought and won."

It is understood that a requisition has been signed by a number of members of the Corporation asking the Mayor to call a special meeting of the Council to consider the action of the Gas Sub-Committee with reference to the dispute. Difficulties raised in connection with standing orders prevented a full discussion of the question at the meetings held on Wednesday and Thursday; and technical objections might be again raised at the adjourned meeting next week. Some of the members who feel strongly that the whole subject should be considered at an early date have, therefore, signed the requisition; and as the dispute is now at an end, they are hopeful that his Worship will grant their request.

In commenting upon "The Surrender of the Sub-Committee," the *Yorkshire Post*, of Friday, tersely summed up the events of the week as follows: "Leeds has in the last three days suffered severely both in reputation and purse. Portions of the town have more than once been practically in the hands of a mob; life has been endangered, and property, public and private, destroyed; scenes of disorder have been repeatedly witnessed, humiliating to every respectable citizen; the civil power has had to call in the aid of the military to quell riot; a long list of injured has been the result of contact between the elements of disorder and order; money has been spent in thousands, and the bill is not yet settled; thousands of workpeople have been thrown out of employment, and all this for—nothing."

Last Saturday *The Times* devoted a leading article to the strike. After recapitulating the events, the writer referred to the arrangement agreed to by the Gas Committee, that the old hands should return to work, and the new ones be compensated by a money payment, and concluded as follows: "This is what Mr. Alderman Gilston thinks an honourable and satisfactory end to the dispute. What honour it reflects on the Gas Committee, or what satisfaction its members can derive from their share in the transaction, is not clear. They entered on a struggle which they found themselves unable to maintain; and they have been forced to surrender at discretion. From first to last it has been a bad business for Leeds. It has cost the town in hard cash some £20,000; and we must add to this the loss and inconvenience which the townsmen have suffered while the strike was going on. Besides all this, the teaching of the strike has been most mischievous. The men have not only been made aware of the commanding position which they occupy, and which they may be trusted to use to good future account, but they have also been brought to commit themselves to an armed struggle with the authorities; and though they may have

come off second best for the time, they have been none the less victorious in the end, and gained what they have been fighting for. The affair has been unfortunate at every point—troublesome while it lasted, discreditable in its conclusion, and worst perhaps of all in the permanent lessons which it will enforce."

Referring to the strike last Friday, the *Globe* said: "We should like to hear the opinion of the ratepayers of Leeds upon the way this business has been managed by their representatives. In the first place the Gas Committee dismiss their servants for refusing what must be supposed to be reasonable terms; then the police—the servants of the Council—fail to protect the imported hands, so that the town is left in darkness, and on the verge of anarchy; and, finally, the Committee, with the unanimous approval of the Council, stultify their original action by an unconditional submission, which will cost their constituents several thousand pounds. If this is a specimen of municipal management, we Londoners may be thankful for Mr. Livesey and for Scotland Yard."

The *Star* on Friday was jubilant at the victory of the stokers, which it regarded as wiping out the failure at Manchester, and to a certain extent compensating for Mr. Livesey's "little triumph" in London. Leeds ratepayers would, the writer said, no doubt appreciate the price they would pay for the performance of the Gas Committee; and he thought it was a pity the members could not be made to pay some part of the bill out of their own pockets.

Gas, Water, and General Investment Trust, Limited.—The Directors have declared an interim dividend for the past half year at the rate of 4½ per cent. per annum on the Preferred, and 5 per cent. per annum on the deferred stock.

Electric Lighting at Southport.—The Southport Corporation have received two notices of intended applications for Provisional Orders to supply electricity within the Borough; and the Gas Committee have decided to recommend the Town Council to refuse their consent, and to apply themselves for an Order.

Sale of Shares.—At the Auction Mart, Tokenhouse Yard, on Wednesday last, Messrs. Edwin Fox and Bousfield sold 100 £10 "A" shares (fully paid) in the *Walton-on-Thames and Weybridge Gas Company*, at £13 5s. per share; and 20 £25 shares (fully paid) in the *Epsom and Ewell Gas Company*, at £46 each.

The Fatal Accident at the Blackpool Gas-Works.—Thomas Hanson, one of the three men injured by the accident at the Blackpool Gas-Works, as reported in the JOURNAL last week, has died at the Preston Infirmary; this making the second death. George Whiteley, the survivor, is in a precarious condition. At the Coroner's inquest held on Hanson, the evidence was the same as that given at the inquiry into Hardman's death; and the jury returned a similar verdict.

Gas Managers and Ambulance Work.—The value of a knowledge of ambulance work was exemplified last Saturday week at Greenfield, near Holywell. A woman fell on the roadway and fractured her arm; but Mr. H. B. Chamberlain, the Manager of the Holywell Gas-Works, who is an active member of the St. John's Ambulance Corps, kindly attended to her injury, and set the bone expeditiously and effectually. In view of the accidents to which men employed in gas-works are liable, it would be well for foremen and managers to possess some knowledge of ambulance work.

Increase in the Price of Gas for the Public Lighting of Richmond.—At the meeting of the Richmond Vestry last Tuesday, a letter was read from the Richmond Gas Company to the effect that the price of gas supplied to the public lamps would, as from the 30th ult., be £3 10s. per lamp per annum, instead of £3 6s. 8d. In conjunction with this letter, another was read from the Vestry Clerk of Hammersmith, asking if the Vestry were going to take any action as to the increase. It was decided to inform the Vestry that if they could show the Richmond Vestry how to improve their position effectively, they would be glad to hear of it, and to co-operate with them.

Gas Exhibition at Bromley.—An exhibition of gas appliances, at which free cookery lectures were delivered by Miss E. Johnson, was opened at the Drill Hall, Bromley, last Tuesday, under the auspices of the Bromley Gas Company; the stove exhibits being furnished by Messrs. H. and C. Davis and Co., of Camberwell. It was opened by Mr. R. Latter, the Chairman of the Gas Company, who remarked that since the last exhibition was held, four years ago, great improvements had been made, as exemplified by the appliances now shown. He pointed out the advantages of gas for culinary purposes; and expressed the hope that the consumers would use it more extensively for cooking and heating, so as to increase the day consumption. If this result followed the holding of the exhibition, it would probably enable the Directors soon to reduce the price of gas. The appliances were on view till Friday; and Miss Johnson gave lectures twice each day.

Gas Explosion and Fire in a Subway Manhole in New York.—Probably the worst of the numerous street explosions which have occurred in New York, took place early in the morning of the 13th ult., when some gas which had leaked into an electric subway manhole at the corner of Broadway and Fulton Street, took fire and was followed by a conflagration of many hours' duration. It appears that some men in the service of the New York Steam Heating Company had been at work on the spot, and, having excavated to a considerable depth below the lines of gas and water mains, had completed their job and were filling up the trench when the explosion occurred. Complaints of leakages of gas had been made beforehand during the progress of the work; and some gas must have found its way into the trench, where it is supposed to have been fired by an over-turned lamp. After the explosion, it was found that there was gas enough leaking to maintain a considerable flame from the neighbourhood of the manhole. It seems to have been left to itself, as it continued to burn for some time until it suddenly increased; and for a number of hours a blaze was produced, six or seven feet high—indicating a consumption of perhaps 5000 cubic feet of gas per hour. After a time the mains were plugged and the gas shut off, when, of course, the flame was extinguished. The damage done to the subways and to the electric wires in them was very great; the loss being placed as high as $70,000.

MANCHESTER CORPORATION GAS SUPPLY.

The Gas Committee's Annual Report Adopted.

The Monthly Meeting of the Manchester City Council was held last Wednesday, when the annual report of the Gas Committee (as given in the JOURNAL last week) was presented.

Alderman LAMB, in moving its adoption, said that although the report might not be what some of the former reports had been, it was a very much better one than might have been expected at one period during last winter. The Gas Committee had been able to meet all their engagements without increasing any of their debts, excepting the adverse balance, which they have left as it was the year before last. They had been able to pay more than £28,000 in interest, and more than £25,500 towards the sinking fund. They had also been able to lose, by a reduction in the price of gas of 2d. per 1000 cubic feet, £24,700 odd; and by leaving the adverse balance where it was at the beginning of last year, they had been able to pay the £30,000 they had promised to the city fund. If these four items were added together, they would about amount to the income of last year—viz., £106,000 odd. The Committee had done this without asking the Council to allow them to advance the price of gas by the 2d. per 1000 cubic feet taken off last year, and without charging the city rates with the cost of street lighting. The Council had great sause to be gratified that the Committee had been able to get over what was undoubtedly a grave crisis which was never expected. The Committee believed that in the coming year they would be able again to return to something like their former condition; for they would have £10,000 less to pay for the sinking fund next year, and he hoped the increased sum which the accounts showed had been received for gas products would be maintained.

Alderman READE seconded the motion.

Mr. A. E. LLOYD said he was glad to hear that the receipts from gas products exhibited an increase of £4000 over those of the preceding year. He should be pleased, however, if the accounts were made a little more clear, so that the sum received for each of these products might be separately shown.

Mr. WORTHINGTON asked whether the question of depreciation had been considered by the Committee during the past year. No one could doubt the extremely profitable manufacture which was in the hands of the Gas Committee; and while the Council were very well satisfied with the work they had done, it was not unsuitable that they should suggest means by which both the ratepayers and the gas consumers might be benefited. He urged that if the depreciation fund (for which he contended there was no necessity) were abolished, a further reduction might be made to ordinary consumers of about 2d. per 1000 cubic feet, and that to users of gas for purposes of power a considerable rebate might be allowed, as was the case in several large towns. The use of gas would thus be increased, especially for the purposes of furnishing power; the employment of coal for engines correspondingly lessened; and the smoke nuisance largely abated.

Mr. ANDREWS complained of the excessive charge appearing in the accounts for collection, in regard to which he thought there was much room for improvement. He found that the sum of £7387 was charged for collecting, which was more than 2 per cent. of the whole amount got in. It appeared to him that more information was needed on this point, and the Council ought to know how much was obtained by the collectors on their rounds. He thought that a counting-house department in the Corporation would very materially reduce the rates in this direction.

Mr. MURRAY said the charge for depreciation was, in his opinion, entirely illegal and unauthorized. If the Committee were not able to see their way to abolish it, they should take the opinion of the Town Clerk or of eminent Counsel such as Mr. Pember, Mr. Littler, Mr. Balfour Browne, or Mr. Pope. After the division on the subject in June last year, he should have thought the Committee would have been justified in taking some action upon it. There had never been any real attempt on the part of the Committee or the Council to justify the charge. It had been defended as a matter of expediency; and it was said that they would have to make a large provision for a sinking fund for Thirlmere, and then would be a suitable time for considering the question. But what had Thirlmere to do with the question of the depreciation of the gas-works? Suppose they had no Thirlmere at all? Each account ought to stand by itself. He thought that this was a very weak reason for attempting to justify what had been done. It was said in the course of the proceedings on the Oldham Gas Bill in 1886, that the system of a depreciation fund was patented by their late Town Clerk, Sir Joseph Heron; but Mr. Littler, who made the statement, was entirely wrong. Sir Joseph reported against a charge for the depreciation in 1857; and in 1887, when he (Mr. Murray) brought the subject before the Gas Committee, he wrote voluntarily to him repeating the view he had previously expressed with regard to it. In the Oldham case, an attempt was made by Mr. Pember, representing the Corporation, to secure as large a rate of interest as 10 per cent., but the Parliamentary Committee would not allow more than 6 per cent., made up of 3½ per cent. for interest on moneys borrowed or to be borrowed, 1½ per cent. for sinking fund, and 1 per cent. for a suitable reserve. Why the Manchester Gas Committee should go on making such a charge, he (Mr. Murray) was at a loss to understand. It appeared to him that, by means of the sinking fund, some hundreds of thousands of pounds had been taken out of the pockets of the gas consumers and ratepayers illegally. He repeated that there was no authority for such a charge; and he said this without fear of contradiction.

Alderman KING said this question was one of common sense, and did not require a specific Act of Parliament. They were bound, as well as others engaged in a manufacturing business, to take an honest balance of profit and loss at the end of a year. Mr. Murray had said that there had been no attempt to justify the charge; but he seemed to entirely ignore the fact that he brought the matter forward in a long and elaborate argument of something like an hour's duration at the Gas Committee, which argument, he congratulated himself, was smashed by his (Alderman King's) reply. Consumers were charged 2s. 6d. per 1000 cubic feet for gas; and the question was whether this was really more than ought to be charged. [Mr. Alderman King quoted statistics to show that the charge for depreciation was a proper

charge to be made, and that therefore things should be left as they were at present.]

The report was adopted.

The Annual Accounts of the Gas Undertaking.

The report of the Gas Committee of the Manchester Corporation, accompanying the accounts of the Gas Department for the year to March 31, was given in the JOURNAL last week (p. 41); and to-day we give an asbtract of the accounts themselves so as to indicate the extent of the work directed from the Town Hall, under the superintendence of Mr. Charles Nickson.

PROFIT AND LOSS ACCOUNT.

EXPENDITURE. *Dr.*

Cannel and coal (including cost of unloading, &c.)			£180,772 3 8
Retort men's wages			40,762 14 6
Retorts, fire-bricks, &c. (including cost of setting)			11,362 7 11
Repairs and maintenance of works, mains, &c.			42,098 7 6
Purifying material and wages			1,431 7 7
Salaries and wages of clerks in superintendent's office, rental and inquiry offices, and meter inspectors			14,520 3 11
Collectors' salaries			7,387 2 4
Rents, rates, and taxes			17,612 17 11
Depreciation (amount written off)			32,838 14 10
Bad debts			539 13 9
Miscellaneous expenses			2,957 14 6
Gas stokers' strike			8,521 5 2
			£360,804 13 7
Balance carried forward			73,546 19 2
			£434,351 12 9
Interest			£28,036 0 9
Street Lighting—			
Wages and repairs	£ 8,087 14 0		8,087 14 0
Add value of gas not charged	20,029 19 0		
Total cost of street lighting	£28,117 13 0		
Sinking fund			23,517 0 0
Balance carried down			13,906 4 5
			£73,546 19 2

INCOME. *Cr.*

Gas-rentals—			
Within the city—			
Private consumers	£250,334 7 0		
Meter-rents	7,735 15 0		
Stove-hire	477 19 1		
Gas consumed in public lamps not included £20,029 19 0			
		£258,548 1 1	
Beyond the city—			
Private consumers	£91,747 16 8		
Meter-rents	3,410 16 8		
Stove-hire	198 3 10		
Public lamps	6,627 8 9		
		101,984 5 11	
			£360,532 7 0
Residual products—			
Coke	£30,484 18 5		
Tar	25,410 2 3		
Ammonia water	16,027 19 9		
			71,923 0 5
Rents of cottages, &c.			321 12 7
Balance of bankers' interest			1,424 12 9
Amount paid by Messrs. Ellis Lever & Co., *re* proceedings in the libel action "Corporation *v.* Lever"	£300 0 0		
Less amount paid over to the Hospital Sunday Fund, as agreed	150 0 0		
			150 0 0
			£434,351 12 9
Balance brought down—net profit on year's working			£13,906 4 5
Balance carried down (deficiency)			16,093 15 7
Amount paid over to the City Fund Account			£30,000 0 0

STATEMENT OF ASSETS AND LIABILITIES.

ASSETS.

Gaythorn station—land, buildings, and apparatus, less depreciation			£195,120 14 7
Rochdale Road station—do.			255,842 11 9
Droylsden station—do.			8,705 12 9
Bradford Road station—do.			400,817 6 2
Street-mains stores (Poland Street)—land, buildings, and apparatus, less depreciation			2,970 9 0
Street-mains—less depreciation			348,100 1 8
Service-pipes laid			57,941 11 8
Hired meters—less depreciation			75,385 14 10
Hired stoves—do.			4,729 1 6
Lamp department—do			8,288 1 7
Cottage property purchase-money			1,652 13 6
Electric lighting—preliminary expenses			145 3 3
Total property			£1,359,699 2 3
Cannel, coal, retorts, and other material in stock			73,633 16 8
Gas-rents and other accounts due to the Committee—revenue account			128,895 3 3
Balance in hand and at bankers'			7,403 17 1
Cash in City Treasurer's hands			583 4 1
Total property and assets			£1,570,215 3 4
Profit and loss account—			
Deficiency on revenue account, March 31, 1889	£10,183 5 11		
Add deficiency this year	16,093 15 7		
			26,277 1 6
			£1,596,492 4 10

LIABILITIES.

Mortgage debt			£709,341 0 0
Sums advanced (not secured by mortgage)			1,930 0 0
Accounts owing for coal, &c.			26,732 0 3
Deposits in hand			31,594 4 11
Interest due on same			3,812 9 8
Cash deposits for due performance of contracts			5,050 0 0
Amount payable on account of cottage property			1,600 0 0
Total liabilities			£780,059 14 10
Sinking fund, as per last statement	£792,915 10 0		
Transferred from profit and loss account for the year ended March 31, 1890	23,517 0 0		
			816,432 10 0
			£1,596,492 4 10

GENERAL SUMMARY OF THE CAPITAL AND REVENUE ACCOUNTS.

RECEIPTS.

Balance brought forward (see Summary, March 31, 1889)			£160,774 10 8
Loans received during the year			5,100 0 0
Amount received for brick making on land at Bradford Road			45 0 0
Sinking fund, transferred from profit and loss account			23,517 0 0
Depreciation, written off capital account			32,838 14 10
Balance of profit and loss account (as per statement)			13,906 4 5
			£236,181 9 11

EXPENDITURE.

Loans repaid			£28,670 0 0
Amount paid over to the City Fund account out of the year's profits			30,000 0 0
Expenditure charged to capital account			35,784 3 8
Stocks on hand	£73,633 16 8		
Gas-rents, &c., due	128,895 3 3		
Cash in hand and at bankers'	7,403 17 1		
Cash in City Treasurer's hands	583 4 1		
	£210,516 1 1		
Less accounts owing to sundry creditors	68,788 14 10		
			141,727 6 3
			£236,181 9 11

APPENDIX A.

Statement of the Lamp and Private Rental (including Meter and Stove Rents) for the Year ended March 31, 1890.

Within the city—			
Private rental	£258,548 1 1		
Public lamps	20,029 19 0		
		£278,578 0 1	
Beyond the city—			
Private rental	£93,356 17 2		
Public lamps	6,627 8 9		
		101,984 5 11	
		£380,562 6 0	
Deduct gas supplied to city lamps and not charged		20,029 19 0	
Total gross rental			£360,532 7 0

APPENDIX B.

Statement of Gas transmitted from the Works in the Daytime and during the Twenty-four Hours—Year ended March 31, 1890.

—	Daytime. Year ended March 31, 1890.	Daytime. Increase or Decrease per Cent.	Twenty-four Hours. Year ended March 31, 1890.	Twenty-four Hours. Increase or Decrease per Cent.
	Cubic Feet.		Cubic Feet.	
April	57,610,000	inc. 0·28	209,076,000	inc. 0·95
May	47,013,000	,, 10·01	166,599,000	,, 6·16
June	33,697,000	dec. 20·93	118,293,000	dec. 9·96
July	41,657,000	,, 0·58	135,892,000	,, 1·23
August	43,688,000	inc. 2·76	164,927,000	inc. 2·34
September	45,962,000	,, 1·28	206,053,000	,, 1·82
October	66,876,000	,, 1·01	305,756,000	dec. 1·77
November	71,612,000	,, 1·84	358,981,000	,, 2·13
December	72,839,000	dec. 15·41	317,106,000	,, 22·72
January	80,521,000	,, 17·98	392,421,000	,, 6·51
February	75,394,000	inc. 11·12	322,080,000	inc. 1·37
March	63,739,000	dec. 7·37	277,279,000	dec. 3·02
Total	700,608,000	dec. 4·04	2,974,463,000	dec. 4·3

	Daytime. Cubic Feet.	Twenty-four Hours. Cubic Feet.
Year ended March 31, 1889	730,076,000	3,108,269,000
Do. do. 1890	700,608,000	2,974,463,000
Decrease	29,468,000	133,806,000

Total quantity of gas transmitted from works	Cubic Feet. 2,974,463,000
Total quantity of gas measured and accounted for	2,865,435,000
Loss (by condensation and leakage)	109,028,000, or 3·67 per cent.

APPENDIX C.

In this appendix particulars are given as to the working from June 24, 1880, to March 31, 1890. The table (which was given in full in the JOURNAL for Aug. 7, 1888) contains statistics as to the number of tons of coal carbonized, the total make of gas, the yield per ton of coal, illuminating power, residuals, &c., for each year in the above-mentioned period. It will be sufficient here to give those for the last financial year, which are as follows:—Coal and cannel carbonized, 302,530 tons; gas made, 2,972,768,000 cubic feet; yield per ton of coal carbonized, 9826 cubic feet; illuminating power, 19·74 candles; make, reduced to 20-candle power, 2,934,122,000 cubic feet; make per ton, 20-candle power, 9699 cubic feet; make of coke, 188,985 tons; do. per ton of coal, 12·5 cwt.; make of tar, 20,778 tons; do. per ton of coal, 13·4 gallons; make of ammoniacal liquor, 7,223,989 gallons; do. per ton of coal, 23·88 gallons; make at 10-oz. strength, 7,017,674 gallons; do. per ton of coal, 23·2 gallons.

APPENDIX D.

This appendix consists of a table showing the number of each size of

meter, and also the number of stoves, in use on March 31, 1889 and 1890, respectively. Of the first-named appliances there were fixed at the former date 78,114; at the latter, 78,602—an increase of 488. Of stoves, there were 1938 in use at the end of last March, as compared with 1760 at the corresponding date in 1889; being an increase of 178. Accompanying the table is a statement showing the number of meters on hire at the two dates above named. On March 31, 1889, it was 65,595; on March 31, 1890, it was 66,902—an increase of 1307. Of course, these figures are included in the totals already given.

APPENDIX E.

Gas-Mains Laid and Taken Up during the Year.

Laid within the city	20,370 yards	
„ beyond the city	9,338 „	
		29,708 yards
Taken up within the city	14,331 yards	
„ beyond the city	2,479 „	
		16,810 „
Net increase		12,898 yards
(or 7¼ miles 138 yards).		
Pipes laid prior to March 31, 1889—		
Within the city	718,841 yards	
Beyond the city	459,479 „	
		1,178,320 „
Total length of mains laid		1,191,218 yards
(or 676¾ miles and 138 yards).		

APPENDIX F.

This consists of a statement showing the amount of gross profit made from the gas undertaking, and the mode of its appropriation, from 1862 to March last. It is, however, sufficient here to give some of the figures for the past financial year, and the totals for the 28 years during which the gas supply has been in the hands of the Corporation:—

	Year ended March 31, 1890.	Total from 1862 to March 31, 1890.
Profit	£73,546 19 2 ..	£2,349,437 5 8
Appropriation of profit—		
Interest	£28,036 0 9 ..	£591,251 0 5
Liquidation of mortgage debt	23,517 0 0 ..	710,012 10 10
Surplus	13,906 4 5 ..	965,365 17 10
Street lighting (gas not included)	8,087 14 0 ..	82,807 16 7
Paid over to Improvement Committee	£30,000 0 0 ..	£991,642 19 4
Borrowed money owing	711,271 0 0 ..	
Amount charged to revenue for depreciation	32,838 14 10 ..	£88,744 2 3
Excess of assets	790,155 8 6 ..	

S. Z. de Ferranti, Limited.—A company has been formed under this title, with a capital of £100,000, in £10 shares, to "acquire any electrical business, and the benefits of any patents relating thereto, and also to carry on the business of manufacturing engineers."

The New River Company's Shares.—In the JOURNAL last week reference was made to the offer of an entire adventurer's share in the New River Company for sale by Sir J. Ellis (Messrs. Farebrother, Ellis, Clark, and Co.) on the 26th ult. The highest bid on the occasion was £109,700, at which figure, we understood, the share was sold. It appears, however, that, in view of the fact that £122,800 was obtained for a similar share a year ago, the auctioneer declined to sell at the price offered.

Salford Gas Matters.—The General Gas Committee of the Salford Corporation have deputed several of their number to inspect the gas-works at Shrewsbury and Ramsgate, where Brin's oxygen system for purifying gas is at work; and on their return, the Sub-Committee will prepare a report on the financial and other questions involved in adopting the principle of gas purification by oxygen at the Salford Gas-Works. The Salford District Lamp Committee have instructed the Superintendent to proceed with the substitution of burners consuming 5 cubic feet of gas per hour in the street-lamps, with the view of testing the same as to sufficiency of lighting during the ensuing winter. The burners in the lamps at present consume only 3½ cubic feet per hour; so that a decided improvement in the lighting of the streets ought to be noticeable.

The Richmond Well.—At the meeting of the Richmond Vestry last Tuesday, the Water Committee recommended that the last instalment of £2000 of the loan sanctioned for the new well and works on the Terrace Gardens should be applied for from the Public Works Loan Commissioners. It was explained that the money was needed to meet the general expenses of the work. The well now yields 120,000 gallons of water daily, which with 4000 gallons from the fissures makes 124,000 gallons. A member inquired of the Engineer (Mr. Peirce) if he thought there was a reasonable probability that the 500,000 gallons a day mentioned in the contract would be obtained with the expenditure of the whole of the £6000 applied for. Mr. Peirce said he could not undertake to promise that, nor could he see any reasonable probability of the quantity being obtained. With the £2000 they would be able to drive 450 feet more in the upper adit. The statement of the Engineer was regarded as anything but satisfactory; but the recommendation was agreed to.

The Northern Coal Trade.—There is still a very full demand for best steam coal, and it retains its firmness at 13s. per ton, free on board. But other classes are generally a little easier; the supply being more abundant. Small steam coal has fallen in price to 6s. 6d., and even from that comparatively low figure a discount is at times allowed. For gas coal there is more variation, and the price may be said to be from 12s. to 12s. 6d. according to quality. In a week or two, the demand will begin to increase; but at the present time it is at a low ebb, especially for the local supplies. Shipments of gas coals are fairly good; but there is not that briskness which was known a month or two ago. For bunker coals, the price is lower—from 9s. 6d. to 10s. 6d. free on board—with a very full supply. Household coals are flat. There is a fair inquiry for manufacturing coals; but prices are decidedly easier, as the lessened demand for blast-furnace coke has thrown much more soft Durham coal on the market. Coke is now quoted at 18s. 6d. to 19s. for shipment; while gas coke is in full demand, with only a very limited output.

EDINBURGH AND LEITH GAS UNDERTAKINGS.

The Annual Accounts of the Commission.

Our Edinburgh correspondent in his "Notes" last week dealt with the principal features of the accounts of the Edinburgh and Leith Gas Commission for the year ended May 15 last; and we are now able to give some additional particulars therefrom.

The capital of the undertakings is shown to be made up of £350,000 (the shares of the two old Companies), upon which annuities to the amount of £34,000 are payable, and a loan capital of £104,698, borrowed upon mortgage at 3½ per cent. The borrowing powers of the Commission are fixed at £300,000; so that there is yet power to borrow £195,301. The capital account on May 15 last year stood at £439,632, of which the works represented £242,466; main and service pipes, with cost of laying, £150,895; meters, £38,718; heritable properties not embraced in the works, £7366; and office furniture, £185. During the year a sum of £30,483 was added to capital, divided as follows: Works, £12,509; pipes, £13,053; meters, £3829; properties not in the works, £350; office furniture, £271; and the new item of gas cooking and heating stoves, £469. The total sum at capital account is £470,115. Deducting this from the share and mortgage capital, there is a balance left of £15,416.

The following are the items (omitting shillings and pence) of the revenue account:—

Expenditure.

Manufacture of gas—		
Coals		£74,693
Purifying materials, oil, water, and sundries used at works		6,139
Salaries of engineers, &c., and wages paid at works		32,764
Repairs and maintenance of works and plant		7,001
		£120,598
Distribution of gas—		
Salaries and wages of rental clerks, inspectors, surveyors, and fitters	£7,184	
Repair and maintenance of pipes	4,739	
Repair and maintenance of meters	4,928	
Miscellaneous charges	54	
		16,907
Management—		
Salaries of treasurer, clerk to the Commissioners, auditor, and treasurer's clerks	£1,517	
Salaries of collector and assistants, and wages of runners	2,761	
General establishment charges, insurance premiums, printing and stationery, office expenses, &c.	2,191	
		6,470
Rents, rates, and taxes—		
Rents and feu duties	£346	
Rates and taxes	8,300	
		8,647
Alterations at Head Office, Waterloo Place		2,597
Law and parliamentary expenses		237
Pensions to officials of Edinburgh and Edinburgh and Leith Gas-light Companies		2,038
Discounts, abatements, and bad debts		3,726
		£161,223
Balance carried to profit and loss account		58,030
		£219,253

Receipts.

Sale of gas		£197,612
Residual products, &c.—		
Coke	£5,499	
Tar and ammoniacal liquor	15,524	
Waste lime	144	
		21,169
Rents of heritable properties not in Commissioners' occupation		445
Transfer fees		26
		£219 253

The profit and loss account shows that the annuities for the year absorbed £34,000; interest on mortgages, &c., £4428; and the expenses of mortgages, £62—making a total of £38,490; and leaving a balance of £23,391. On the credit side of the account, it is seen that the balance at May 15 last year was £39,066. Deducting from this, £7267 carried to the sinking fund for the redemption of annuities, £1036 transferred to the sinking fund for the repayment of money borrowed, and £27,000 placed to reserve fund, there remains a balance of £3761, which makes, with the balance of revenue for the past year, as shown above, a total of £61,792.

The sinking funds account shows a sum of £1059 set apart for the repayment of money borrowed; and £7426 for the redemption of annuities—making together £8486. These funds are invested to the amount of £8304 in mortgages of the Edinburgh Water Trust.

By their Act of Parliament, the Commissioners are bound to set apart not less than 1 per cent. per annum on the amount borrowed under the Act for repayment, and not less than 15s. per cent. per annum on the amount of the capital value of annuities, at 28½ years' purchase, which sums will amount to £1046 and £7267 respectively. Deducting these from the balance at the credit of profit and loss account, £23,391, leaves a free surplus of £14,987 to be disposed of.

The Pollution of Rivers.—A conference of representatives of the Lancashire and Cheshire County Councils and the various sanitary authorities in the two counties, on the subject of the pollution of the Rivers Irwell and Mersey, was held last Thursday at Manchester. The Right Hon. J. T. Hibbert, who presided, explained a scheme for the establishment of a Joint Watershed Board, which would deal with the whole question of the pollution of the two rivers and their tributaries. A joint application for a Provisional Order had already been made by the two County Councils. Resolutions were adopted recommending that the representation on the proposed Board should be on the basis of rateable value, one member per £500,000 sterling, and that the Board should consist of 25 members.

ROTHERHAM CORPORATION GAS-WORKS.

The Price and Sales of Coke.

It has already been intimated that a small Committee was, in the early part of this year, appointed by the Rotherham Town Council to inquire into the price and sales of coke at the gas-works during the last eighteen months. The Committee reported at last Wednesday's meeting. Their principal finding was to the effect that the coke sold at the gas-works during the period of eighteen months preceding the 5th of February last (*a*) was sold under its market value, (*b*) and resulted in a loss to the Corporation of £1388 5s. 10d., as compared with the prices obtained by immediate competitors. The Committee recommended that all offers made for the purchase of gas coke by contract be submitted in future to the General Committee; and that members of the Corporation who bought coke in large quantities from the gas-works should not in future influence the selling price. The introduction of the report gave rise to a very prolonged discussion. At the outset, Alderman Gummer stated that he knew he was one of the parties alluded to in the report; and he asked that before the matter was discussed, each member of the Council should be supplied with a copy of the evidence of certain individuals who had been before the Committee. This request was supported by the Mayor. The Chairman of the Committee (Mr. Hirst), however, proceeded, in a lengthy speech, to move the adoption of the report, saying that although the report was not so strong as was asked for by some members of the Committee, more especially himself, yet if they read between the lines it was strong enough, and the strongest that had ever been submitted to the Council. They had three courses open—either to adopt, amend, or reject it. As a large ratepayer, he had lost his share of the £1388 alluded to, and was quite willing to prevent the recurrence of the same thing in future. But this would not satisfy the ratepayers generally, because they would want to know why they had lost what practically amounted to 3d. in the pound on the rateable value. It was not for him to dilate upon the evidence, and incriminate any member of the Corporation; but it was for the Council to decide whether they should recover the £1400, or whether it was to be reckoned as a dead letter. He had no objection to every member being furnished with a copy of the evidence, and then for the Council to decide what should be done with the report. Mr. Charles having seconded the motion, Mr. Woodhouse moved an amendment, referring the report back, so that the members of the Council might be supplied with a copy of the evidence, and other documents and information which were in the hands of the Committee. Alderman Marsh seconded the amendment, arguing that the Council could not vote upon the subject until they had had full information. Mr. Gummer contended that Mr. Hirst had made charges against members of the Council; and the only statement submitted in proof in the report was that the sales of coke in Rotherham, as compared with those at Sheffield, had resulted in a loss of £1388. But supposing the two members of the Corporation referred to were large purchasers of coke at the gas-works, they did not purchase the whole, nor one-half, nor one-quarter, and not even one-tenth of the quantity produced. Mr. Hirst here inquired why a contract offered by Messrs. Steel, Peech, and Tozer to the Corporation was suppressed, and not presented to the Committee. Alderman Gummer observed that this was a matter not reported on, to which Mr. Hirst replied: "We have reported to that effect; but we want to spare you if we can." In supporting the amendment, Mr. Mason described the report as about the most flimsy, weak, and contemptible thing that had ever been put before the Council on a question of such importance. So far as he was concerned, he had no responsibility for any misdoings of the Gas Committee; and he considered every member of the Council at the time was either implicated in the matter, or should be exonerated from the charges and allegations made against them. Alderman Neill spoke against supplying a copy of the evidence to the members. Mr. Cox said he thought the charges which had been made were serious; and he did not think they ought to be held over from month to month in such a vague way as they would be by the adoption of the amendment. He maintained that the coke had been sold at market value, and that every member of the Committee was responsible just as much as the Mayor for fixing the price. The Mayor pointed out that it was stated in the report that the sale of coke had resulted in a loss to the Corporation. He had been the Chairman of the Gas Committee; and if this had been the case, no doubt a certain amount of blame would be attached to him by those who had been discussing the question. He gave some statistics, comparing the sales of coke during the eighteen months with those at gas-works in the immediate neighbourhood. The Committee's report stated that there was a loss of £1388; but compared with Huddersfield, they had actually made a profit at Rotherham of £2040, and with Wakefield, a profit of £1157. The prices at Rotherham, too, as compared with those at Doncaster, gave a profit to Rotherham of £598, and with Barnsley of £54. He had instructed the Secretary (Mr. T. Bellamy) from time to time to inquire at what prices these and other towns were selling coke, so as to enable the Committee to come to a conclusion in fixing the price. The charge for coke had never been reduced. Putting Sheffield, Doncaster, Wakefield, and Huddersfield together, and taking the quantity of coke sold by the Corporation and the prices from time to time, they had actually obtained a higher price for coke at Rotherham. The average for the towns named had been 7s. 10d. per ton; and the average in their own case had been 8s. 9d. per ton. The amendment in favour of the consideration of the report being deferred until the next meeting, so that a copy of the evidence and statements furnished to the Committee could be sent to every member of the Council, was then passed.

The Sale of Coke at the Stockport Gas-Works.—On the motion for the approval of the Gas Committee's proceedings at the meeting of the Stockport Town Council last Wednesday, Mr. Morley moved an amendment referring back a minute dealing with the contracts for coke, on the ground that the Gas Committee had in respect to the sale of that residual given an undue advantage to outsiders. People at Oldham, Knutsford, and Gorton, he said, were able to buy coke from the gas-works at 4½d. per cwt., while the townspeople had to pay 6d. The amendment was defeated.

PARÁ GAS COMPANY, LIMITED.

The Ordinary General Meeting of this Company was held last Thursday, at the London Offices, No. 16, St. Helen's Place, E.C.—Mr. ULICK J. BURKE in the chair.

The SECRETARY (Mr. T. S. Borradaile) read the notice convening the meeting; and it was agreed to take as read the Directors' report and the statement of accounts for the half year ending March 31, a summary of which appeared in the JOURNAL last week (p. 42).

The CHAIRMAN, in moving the adoption of the report and accounts, congratulated the shareholders upon the improved state of the financial relations of the Company with the Government; the arrears, which the shareholders had constantly heard of, having been to a large extent paid off. It had, he said, been an exceedingly difficult matter to get these arrears discharged by the Government; but now that a new departure had been made by them, he hoped care would be taken to see that more regular payments were made. The amounts due from the Central and Provincial Governments at the date of the closing of the accounts were equivalent to £9541, as against £15,137 on Sept. 30 last year. Since the accounts were closed, further arrears had come in; so that the sum owing by the Governments had been considerably reduced. It was perhaps not for him to predict what might be the future of the present Republic of Brazil or the Government of Pará; but everyone must certainly feel that this awakened sense of justice to the claims of their creditors would have a beneficial effect upon the credit of the Government—in Europe at all events. He hoped they might augur from this that the Company would be treated in much the same way in the future. Not only had the arrears been paid up, but the current accounts had been met more promptly. Nevertheless the Directors had not overcome all their troubles, because had the Government discharged the accounts as they became due, the Company would not have had to suffer, as they were now doing very severely, owing to the loss on exchange and other matters attributable to the long delay in settling their claims. The loss on exchange as regarded the arrears was £1700, which was a very serious matter for them. The Directors were calling the attention of the Government earnestly to this and other questions—such as the fines, which should be repaid. Turning to the accounts, he recalled to mind the fact that when the shareholders met in January, the Directors promised that, if there should be sufficient funds, and there was no objection to the convening of another meeting, they would pay a dividend. It was proposed to pay a dividend, for the half year ending September 30 last, at the rate of 4 per cent. per annum, free of income-tax, on the ordinary shares of the Company, and at the rate of 7 per cent., less income-tax, on the preferences shares for the half year ending March 31. From the balance at the credit of profit and loss (£12,543), it was intended by the Directors, under the powers given them in the Articles of Association, to place £5000 to the reserve fund. It appeared to the Board that it was of paramount importance that the Company should be put in a sound financial position. The mere fact of their having money in hand did not entitle them to divide it, because they had a debenture loan of £7200 which had only about a year to run; and the Directors would have to consider the best way of meeting it. As a first step towards this object, it was proposed to put by the £5000. Deducting this sum from the £12,543, there remained £7543, from which they had allocated £1500 to the formation and maintenance of a "coal reserve." Of course, it would be understood that carrying coal across the Atlantic in sailing ships was not the same as having the coal brought down from Newcastle to the Thames by steamer. The fact of their having to send the coal so far, caused the Directors great anxiety. If the ship was out a long time; and they happened to know that the stock of coal was running short, he need hardly say it was a matter of the gravest concern to the Board, and placed the Manager in a position which he should not be called upon to occupy. He instanced the case of a ship called *Marie*, which sailed on Feb. 14, and should have reached its destination in 50 days; but as a matter of fact, it did not complete its journey until 75 days had elapsed. It happened to arrive precisely at the same time as another ship which was sent out to relieve her; and to unload them both caused a great deal of difficulty and trouble. If such ships as the *Marie* did not arrive at the proper time, then it was necessary for the Directors to get what coal they could packed into mail steamers, or to charter a steamer to take out coal. This was a very expensive proceeding, as the freight per ton of coal by sailing ship was 18s., whereas by steamer it came to at least £2; and when they had to transmit as much as 600 tons by steamer, it made a considerable hole in their finances. Therefore it was absolutely necessary they should have a reserve of coal in stock on the works. With regard to the operations of the half year, there was not much to say. Everything had been going on exceedingly well; and there were no startling differences to call attention to. He regretted to have to state that the improvement had not taken place in connection with the private lighting which they had reason to hope for in consequence of gas of higher illuminating power being supplied; but when the consumers found out that a better illuminating power was furnished, then he thought gas would begin to assert itself, and the consumption would advance. However, there had been a slight increase in public lamps, public establishments, and private lights. As to the residuals, it was very difficult in Pará to dispose of coke; and there was a decrease in the amount received for tar. Illuminations, which was a profitable branch of the business, exhibited an increase. On the question of the concession, the Chairman said that the Directors had hoped to have been in a position at this meeting to give the shareholders some fresh information in regard thereto. It was a subject they never lost sight of; and their Manager (Mr. J. G. Newbigging) constantly kept watch for a chance to push it forward. Only recently they had hoped the time was approaching when they would be in constant communication with the Government, and would successfully negotiate the matter. Unfortunately the elections were about to take place; and it was doubtful whether anything would be done in connection with the concession until the beginning of next year. Respecting the suggestions made at the previous meeting, that the Directors should make some effort to keep a little closer in touch with affairs at Pará either by a member of the Board going out, or by the appointment,

in conjunction with other companies, of an inspector, they had given very careful consideration to the proposal, and had come to the conclusion that it would be impracticable. They had great confidence in their Manager; and it would be of no use sending out a man unless he was specially qualified to judge the condition of the plant, besides which it would be an expensive proceeding. In conclusion, the Chairman spoke in very complimentary terms of the services rendered to the Company by the Secretary, the Manager, and the staff generally.

Mr. PLOWES seconded the motion.

Mr. CUFF said that he thought the report was a very favourable one. The increase in private lighting he considered was satisfactory; being nearly 10 per cent. He also put some questions, the character of which will be gathered from the Chairman's reply.

The Chairman stated that the price of coke in Pará must necessarily vary to a certain extent according to the position of the local market. As to the decrease in meter rentals, he was sorry to say the Government had put a tax upon meters, which affected the price of them; but they did not think it wise to protest against this. The increase in the cost of coal was due principally to the extra expense of unloading; and the fact that, notwithstanding this increase, the item for coal was less than in the corresponding half year, was accounted for by the smaller quantity carbonized. In the past half year, 2104 tons of coal were used, as against 2382 tons in the corresponding period of 1888-9. The make of gas per ton of coal had increased very considerably; the average return for the half year ending March being 11,488 cubic feet.

The motion was unanimously carried.

The dividends recommended by the Directors were then declared; and a vote of thanks to them concluded the proceedings.

PLYMOUTH GAS COMPANY.

A Satisfactory Year's Working.

The Annual Meeting of the Plymouth Gas Company was held on the 26th ult., under the presidency of the Deputy-Chairman (Mr. R. Snow), when the Directors were able to report a continued increase in the business of the Company. After paying the authorized half-yearly dividend, in January last, the balance remaining to the credit of the profit and loss account amounted to £26,278 13s. 10d. Out of this sum the Directors recommended the payment of a dividend at the rate of 12½ per cent. on the original shares, and 9⅜ per cent. on the additional shares. The disturbed condition of the labour market has been a source of great anxiety to the Directors, and has resulted in a large increase of wages, combined with shorter hours of work; and this, together with the advanced price of coals and other materials, has added considerably to the cost of production, and indefinitely postponed the prospect of any further reduction being made in the price of gas. The Board also referred to the late Engineer's health, which for some time had prevented him from giving that constant attention to the supervision and control of the works, which the Directors considered essential in the interests of the Company; and consequently Mr. Browning retired at Lady-day last. It was mentioned that his connection with the Company extended over a period of 30 years, and arrangements had been made whereby the Directors could obtain the benefit of his advice and experience whenever required. Mr. H. Townsend, from the Dewsbury Gas-Works, it was formally intimated to the shareholders, had been appointed to succeed Mr. Browning. In moving the adoption of the report, Mr. Snow alluded to the Company's recent labour troubles, which had entailed a good deal of expense on the Company; and in addition to this coal had increased in price, besides the difficulty experienced in obtaining supplies. On the whole, however, the prospects of the Company were very good; and there was no cause at all for dissatisfaction. Replying to a shareholder's question as to whether the men were not satisfied with their position, the Deputy-Chairman said everything seemed to be going on very comfortably. But one of their difficulties had been that after concessions were made and the men were, as they thought, satisfied, fresh demands had been sprung upon them. At present the men were working eight hours a day instead of twelve, and receiving higher wages, and they seemed contented. The report having been adopted, the dividends declared, and the retiring Directors re-elected, Mr. W. Lethbridge proposed a vote of thanks to the Directors and staff, who, he said, had earned the gratitude, not only of the shareholders, but also of the consumers, by the ability with which they had managed the affairs of the Company under circumstances of great difficulty during the past year. As the result of their management, there had been no diminution in dividends or increase in the cost of gas, although the price of coal had gone up, and they had been compelled to make a large addition to the workmen's wages. The agitation among the men had arisen not merely from a knowledge of the great struggles which had taken place in London and elsewhere, but also from the presence of paid agitators who came to create dissatisfaction. Happily the trouble was dealt with by the Directors with dignity and tact, and without entailing the least inconvenience on the general public—very few of whom, indeed, were aware of the anxiety and difficulty through which they were passing. The efforts of the Directors were ably seconded by the staff, who were perfectly loyal to the Company, and did their best to promote a satisfactory state of things. If the announcement had been made that day that the price of gas had been raised, it could scarcely have created dissatisfaction, because the public knew all the circumstances, and he was sure they would continue to feel every confidence in the Directors. He extremely regretted the absence of the Chairman of the Company and its cause (the recent death of his wife); but he hoped Mr. Henderson would for many years be able to give them the benefit of his experience and great business capacity. The Chairman, in acknowledgment, said the Directors had no reason to complain of the men at present; and if they were able to make good contracts for coal, they would continue to sell gas at the present very low rate. Mr. J. Wills, in also responding, said everything was going on happily at present; and he was sure they all desired to let bygones be bygones. Mr. J. Thomas replied on behalf of the staff, and remarked that, although there was no intention for the present to increase the price of gas, that had been done in many places throughout the country.

THE SALFORD CORPORATION AND THEIR LEVER ACTION.

Proceedings in the Town Council.

Immediately after the decision given by the Judges of the Queen's Bench Division last Saturday week in the appeal by Mr. Ellis Lever against the verdict recently returned against him at the Leeds Assizes at the suit of the Salford Corporation, Mr. J. G. Mandley intimated his intention to ask the Mayor and ex-Mayor, at last Wednesday's meeting of the Corporation, whether, having regard to the opinion expressed by Mr. Justice Vaughan Williams, they would move the Court of Chancery to quash the agreement with Hunter, and to proceed for the recovery of the bribes from both contractors and servant. He remarked that considerable expense had already been incurred by a few of the more public spirited of the ratepayers in fighting against what they have deemed to be not only an illegal compact, but a highly immoral proceeding, reflecting on the honour of the borough; and he therefore trusted that the Council would take such action as to render unnecessary any further litigation on the part of the ratepayers. The following is the text of the questions Mr. Mandley afterwards sent to the Mayor: (1) "Whether, having regard to the very decided opinion expressed on Saturday last by Mr. Justice Vaughan Williams as to the legality of the agreement made with Hunter by the Corporation, it is your intention to ask the Council to empower you to instruct the Town Clerk to take prompt steps to get quashed the said agreement, on the ground that it has been judicially pronounced to be illegal and *ultra vires*, of no effect, and void as against public morality?" (2) "Whether, seeing that the said agreement is 'utterly invalid,' and could not be successfully pleaded by Hunter, nor by any of the incriminated contractors, the several actions begun against Hunter and the contractors in the Court of Chancery will now be continued and prosecuted with vigour?"

At the Meeting in question, at the opening of the proceedings,

The MAYOR (Mr. B. Robinson) said he had received a letter from Mr. Mandley of which he felt he ought to give the members the pith. Mr. Mandley asked whether the Council would now take steps to get the agreement between Hunter and the Corporation quashed. Well, he (the Mayor) could only say he thought that, seeing the case was now in the Lancashire Court of Chancery *sub judice*, the question of Mr. Mandley was uncalled for. It would be very unwise for the Council to interfere in any proceedings that were now before the Law Courts. If the agreement was, as Mr. Mandley said, illegal, the Law Courts would decide it. He did not see why the Council should take action against themselves, when other parties were doing so for them. Therefore he could not recommend the Council to entertain Mr. Mandley's proposal.

Mr. RYCROFT inquired whether there was any intention on the part of the Corporation to carry out the suggestions of all the Judges, that they ought to sue all the contractors who had defrauded the Corporation. He thought, the opinion of Mr. Justice Charles, as well as of Mr. Justice Vaughan Williams, was that the contract with Hunter, assuming that it was a good one, merely operated with reference to Hunter, and not with reference to the contractors.

The MAYOR said the question had been answered repeatedly. The Council had always taken the position that, if they could get evidence against any contractor outside the agreement, they were prepared to take action.

Alderman HUSBAND thought Mr. Rycroft's question was one that could very properly have been put to the Consultative Committee which had been appointed to deal with the matter, and of which Mr. Rycroft was himself a member.

Alderman DICKINS said he had received a similar letter from Mr. Mandley, who, he regretted to see, was not present at the meeting. He could only endorse very fully what the Mayor had stated. The observations which were made by Mr. Justice Vaughan Williams were uncalled for, because the Court was not called upon to decide whether the agreement was valid or otherwise; it was simply asked on behalf of Mr. Lever to quash the judgment of Mr. Justice Day. The question was now in the Court of Vice-Chancellor Bristowe; and it was for the Vice-Chancellor to give a decision. It seemed to him that it was a little indecent on the part of Mr. Justice Vaughan Williams that he should have given the opinion he did before the case had been thoroughly tried in Vice-Chancellor Bristowe's Court. He thought they were bound to wait until the gentlemen who had formed themselves into a Committee for the protection of the inhabitants of the borough of Salford had brought their action to a successful issue.

Mr. HEWITT inquired whether it was in order for a member of the Council to say that one of Her Majesty's Judges had not been decent in what he had said in giving judgment.

Alderman DICKINS: That is my opinion.

The matter then dropped; but later on Mr. Mandley entered the Council, and made an effort to re-open it. On the minutes of the Finance Committee being read,

Mr. MANDLEY inquired whether he was in order in asking that the questions he had addressed to the Mayor should be answered.

The MAYOR said that had already been done, and an answer given to the question, in Mr. Mandley's absence.

Mr. MANDLEY said he hoped advantage would not be taken of any technical point to burke discussion. His question properly arose on the minutes of the Finance Committee which were before the Council.

The MAYOR said he must protest against these interruptions of the ordinary business. Mr. Mandley ought to have been there in time. There had been no attempt made to burke discussion.

The ordinary business of the Council was then proceeded with.

The Local Papers on the Decision.

The Manchester papers all comment on the terms of the judgment delivered in the High Court of Justice last Saturday week; mainly basing their severe criticism on the unmistakeable utterances of Mr. Justice Vaughan Williams.

The *Manchester Examiner*, after quoting from the remarks of the learned Judge to the effect that the "Hunter Compact" was an immoral agreement, and void as against public morality, says: "He

might have used even stronger language than this had he had placed before him in evidence the facts admitted by the Town Clerk at the recent trial in Manchester, with reference to the circumstances under which the agreement was made the act of the Corporation. The pronouncement, however, is quite decided enough not only to justify Mr. Howorth, Mr. Mandley, and the Ratepayers' Committee in everything they have said and done in the matter of the compact, but to encourage them to renewed efforts against that disgraceful arrangement. Both Mr. Justice Charles and Mr. Justice Vaughan Williams have repelled Lever's contention that his liability to the Corporation was wiped out by the composition with Hunter. It was only the Corporation's right to recover from their dishonest servant the money he had received in bribes at their expense, that was compounded for in the agreement. Over and beyond that right, there remain to the Corporation other two rights to sue for the recovery of money in this matter. These are their right as against Lever to recover the excess over the market price which he secured in virtue of his compact with Hunter, and the right of the Corporation to sue the rest of the fraudulent contractors. The last is decidedly the most important of the number; and it must be a great relief to the Salford ratepayers to learn, on such high authority, that it remains good still, in spite of the endeavours of the majority in the Corporation to sell it for £10,000 and the privilege of becoming the bondsmen of Mr. Samuel Hunter."

The *Manchester Guardian*, after a lengthy review of the decision, and referring to the part Mr. Justice Vaughan Williams took in it, says: "The learned Judge holds that the agreement 'was illegal, *ultra vires*, and of no effect.' He comes to this conclusion because, in his opinion, 'the Corporation had no right to present to Hunter the amount he had received in bribes on account of the Corporation.' He further thinks that 'the agreement to present an intended witness with moneys proportioned to the result of his evidence is an immoral agreement and void as against public morality.' Assuming that the agreement has any validity, the Judge is not sure whether, if the £10,000 was paid as agreed upon on the 31st of December, the whole of the damages accruing in the present action would not go into the pockets of Hunter; but, as in his opinion the agreement is of no effect or validity, the construction is immaterial. This is the first time the agreement with Hunter has come before a Court of Law on its merits; and this is the judgment pronounced upon it—not by indignant members of the Salford Town Council, nor by incensed ratepayers, nor by correspondents in the newspapers, but by one of the Judges of the Queen's Bench. In his opinion, it is void as against public morality; and the reasons he gives for viewing it in that light are such as those who made it can hardly reflect upon without the deepest shame and humiliation. We have at times spoken freely of the morality of the agreement. We should be well content to substitute for our remarks the comments of Mr. Justice Vaughan Williams. He at any rate can be actuated by none of those sinister motives which have been freely ascribed to all who have ventured to call in question the proceedings of the Corporation. What now becomes of this agreement? Have we reached the last stage of its disgraceful history? We are told on the highest authority that it is not only immoral, which might perhaps be excused, but that it is invalid and of no effect. It can screen no one, none of the contractors, not even Hunter himself. Here is material for reflection; here are questions raised which may have to be decided. But the chief feeling which will be roused by the judgment pronounced in the Queen's Bench will be one of indignation at the short-sighted levity and the blind indifference to moral considerations that have cast a stain on the reputation of a great and ancient borough."

DAMAGE TO GAS-PIPES BY LIGHTNING AT FILEY.

It is rather remarkable that the publication of the article on "Gas-Pipes and Lightning Conductors" in last Tuesday's JOURNAL should have been followed by the receipt of an account of serious injury to the gas-pipes in Filey Church, in consequence of a thunderstorm which occurred in that village on the 28th ult. On that day the weather suddenly changed, and the rain came down in torrents, accompanied by successive flashes of lightning and peals of thunder. Shortly after one o'clock in the afternoon, a very vivid flash of lightning struck the church, doing a considerable amount of damage, which is, fortunately, covered by insurance. The church tower was surmounted by a weather-cock in the form of a fish, which was attached to an iron rod fixed on an oak mast. The lightning struck this mast just where it was joined to the rod bearing the vane, and, splintering it into matchwood, tore up the lead covering a portion of the roof, and the electric fluid running down the side of the building smashed and tore away a pipe connected with the heating apparatus. It seems then to have entered the church, but without doing any damage until it reached the ground, where it snapped upwards of twelve gas-pipes connected with the main outside. Running underground along this main, the electricity broke the main-pipes in several places at the junctions, until it reached a point opposite a farmhouse, where with a sudden shock it extinguished the gas in the cooking-range, and then its force appears to have been spent, as no more damage can be traced. For upwards of half-an-hour afterwards the electric fluid could be smelt, and the escape of gas was very large. The damage to the church is estimated at about £12.

A correspondent (the Engineer and Secretary of a Gas Company in the neighbourhood) has kindly sent us the following additional particulars in regard to the occurrence: "The church is heated by two stoves placed one in each side isle; the flues (which are 6-inch cast iron) being carried through the roof, and then up the side of the tower nearly to the top. Immediately above the roof, the pipes have a guard to prevent the rain running down the outsides into the interior of the building; and at that point they are jointed with india-rubber insertion. From the top, as far as the joint, the pipes were rent to pieces by the lightning; below it they were not damaged. In the interior of the church, a few feet away from one of the flues, there is a ¾-inch gas-pipe running up from the floor to the roof to supply gas to a pendant hanging in the transept. The electric current appears to have travelled down this pipe; a large splinter being torn off the wooden floor where it passes through it, and thrown across the church. Whether the current passed along this pipe to the meter, which is a 60-light dry one, or found a shorter circuit to the service-pipe, there is nothing to indicate; but that it went into the service-pipe there is abundant evidence. The service is of cast iron, and made with 1¼-inch pipes with turned and bored joints. The damage commences about 20 yards from the building, and extends over some 80 yards. In that length, eight or nine of the sockets, but not consecutive ones, are split or rent open; in some instances pieces of the socket being broken completely off. The fractures are all on the underneath side of the pipes, and the faces have a fused appearance. The soil is a clayey loam, and would probably, from the absence of any rain for some time previously, have been somewhat dry. The church had no lightning conductor to it."

THE FUTURE OF GAS IN AMERICA.

From "Progressive Age," June 16.

Occasional paragraphs in newspapers and current rumour in gas circles for some time past, report the formation of an Anglo-American Gas Company that is expected to absorb a number of gas plants in several of our principal cities now controlled by a Syndicate, and furnishing the capital to acquire plants in others that are not at present within their control.

If it should appear, as reported, that $50,000,000 will be subscribed equally by American and English capitalists, and placed under the management and control of American and English brains, enterprise, and experience, for the purpose of reaching out for and increasing the profit of the gas business of America, we must admit that the undertaking is feasible, and certain to return large and constantly increasing profits. As a matter of fact, the gas business of America is to-day but a trifle beyond the experimental period. Real progress in its development may be said to have begun only four or five years ago, with the introduction of improved methods for manufacturing gas; and to-day the public is burning more gas for illuminating purposes alone than ever before. If it should prove true that English experience is to become influential in the management of the gas business in America, we believe such influence will be highly beneficial; for somehow the English gas manager has a knack of getting more customers and furnishing more gas *per capita* than our people, and if he can teach us how to accomplish this result, it will be far from proving an evil to have him associated with us in the active management of our gas properties.

Those who are closely allied to the gas industry, seldom stop to think how important a part gas occupies in the business and social world; but if we reflect a moment we must realize that, as an illuminant, it is positively indispensable, and that the most vigorous competition of electricity seems only to have stimulated the demand for gas. In December last, when the authorities of New York cut down all electric wires, and practically cut off electric illumination, and the users of electricity throughout the city returned to gas, we have it on the authority of the Engineer of the Consolidated Gas Company that the increased tax on his generating capacity was hardly appreciable. During that month, this Company was sending out approximately 25 to 27 million cubic feet per day; and the impression on this enormous daily send-out made by the return of those who had previously been using electric lights for illumination, was so small that the additional few hundred thousand feet required occasioned no special comment at the works of the Consolidated Company.

The business of supplying gas in this country, as we have intimated, is only in its infancy. American cities are increasing out of proportion to the general increase of population throughout the country. As evidence of this, it may be stated that, at the beginning of this century, but 3 per cent. of the total population were dwellers in cities. In 1880 this percentage had swelled to 22 per cent.; and we now must have not less than 30 per cent. of the whole population residents of cities and towns.

To those intimately associated with, or who have followed the advances made in, the manufacture of gas, the increasing value of gas-works property of this country is settled beyond all question. It is now positively known that the introduction of electricity has really cut no important figure so far as to curtail the gas output; and it is well known that since the introduction of electricity for street illumination, the loss to gas companies of a few street gas-lamps have in all cases been more than offset by the marked gains from increased private consumption—directly traceable to the demand for more light in order to equal the strong high-candle powers of the electric arc lights and the dazzling brilliance of the incandescent lamps. Reliable statistics, however, will show that there are probably, throughout the country, as many street gas-lamps in use to-day as before the introduction of electric illumination for street lighting; a contrary impression having become general because of the disappearance here and there of a familiar street gas-post and the substitution of an electric. The growth of American cities is so rapid that a great number of gas-lights are annually erected in suburban and outlying sections.

One point of particular note in the gas business is the many improvements that have been introduced during the past few years, that have greatly reduced the cost of manufacture, and which have resulted in a material reduction in the price of gas to the consumers. In the Massachusetts Gas Commissioners' report for 1890, we find these pertinent remarks: "The increase in the output of gas has been large during the past few years. . . . This increase is due, no doubt, to a considerable extent to the reduction in price made by most companies during the past five years, some of which have made several reductions during that time." Approximately $500,000,000 is to-day invested in American gas securities; and there are few companies not making satisfactory earnings. But one State in the country pretends to keep a careful record of the business of its lighting companies—the Commonwealth of Massachusetts. From the latest report of the Board of Gas and Electric Commissioners of that State, we learn that 58 gas companies operating therein paid to its stockholders $1,006,743; but seven companies passed dividends, and of these in some cases the cause may be attributed to "betterments" and their introducing electric light plants, or other improvements that have

eaten up their surplus. In Massachusetts we find several companies charge off liberal sums to "depreciation account;" and numerous others have "reserved fund accounts," in which handsome surplus has been laid aside for future contingencies. The following gas companies in cities of Massachusetts paid dividends as stated: Adams, 20 per cent.; Boston, 10 per cent.; Cambridge, 10 per cent.; Charlestown, 10 per cent.; Quincy, 12 per cent.; East Boston, 10 per cent.; Fitchburg, 10 per cent.; Haverhill, 10 per cent.; Lowell, 10 per cent.; Fall River, 10 per cent.; Newburyport, 18 per cent.; Pittsfield, 16 per cent.; Roxbury, 10 per cent.; Taunton, 15 per cent. In thirteen other cities, each company paid 8 per cent. In twelve others, each company paid 3 per cent. It will be instructive to show the output of gas in some of the principal cities representing all sections of the country between 1885 and 1890.

	1885.		1890.
Denver	120,000,000	..	210,000,000
Macon	15,000,000	..	37,000,000
New Albany	15,000,000	..	25,000,000
Des Moines	40,000,000	..	60,000,000
Baltimore	900,000,000	..	1,200,000,000
Boston	852,000,000	..	1,439,000,000
Cambridge	66,000,000	..	120,000,000
Fall River	54,000,000	..	67,500,000
Lynn	40,000,000	..	63,000,000
Lowell	146,000,000	..	210,000,000
Grand Rapids	40,000,000	..	100,000,000
Kansas City	140,000,000	..	225,000,000
St. Joseph	50,000,000	..	70,000,000
Philadelphia	2,758,000,000	..	3,250,000,000
St. Louis	790,000,000	..	1,080,000,000
Omaha	40,000,000	..	150,000,000
Jersey City	160,000,000	..	290,000,000
Paterson	60,000,000	..	97,000,000
Brooklyn	510,000,000	..	1,250,000,000
Buffalo	95,000,000	..	110,000,000
New York City	2,375,000,000	..	8,510,000,000
Rochester	200,000,000	..	230,000,000
Troy	50,000,000	..	130,000,000
Cincinnati	730,000,000	..	1,000,000,000
Columbus	150,000,000	..	200,000,000
Providence	350,000,000	..	485,000,000
Nashville	90,000,000	..	100,000,000
Richmond	154,000,000	..	180,000,000

Heretofore altogether too little attention has been given by our gas managers to the proper advancement of the gas-fuel branch of the business; and it is in this respect that English towns of similar size get the better of us. The foreign gas manager feels it his bounden duty to secure every possible consumer, no matter how small the consumption; on the other hand the American, with his natural tendency to avoid small things, will not go to the trouble to secure the little fellows. This is best illustrated by stating that ten English towns of 10,000 population each show an average of 927 consumers to the town; while the same number of towns in Massachusetts show but 311 consumers to the town.

A wide and practically undeveloped field now presents itself to all existing gas companies, in the rare opportunities for the supply of gas for fuel. Until quite recently, gas managers have given very little attention to the development of this (to be) important branch of the future gas supply. We attribute past want of energy in this direction to the belief on the part of the public that gas is too expensive to substitute for coal; and to a lack of knowledge of the cleanliness and convenience of gas instead of coal for cooking, and a thousand and one other purposes that it is admirably adapted for. Another obstacle has been found in the imperfection of the appliances offered for the utilization of gas. But recently very marked improvement has been made in the perfection of cooking and heating devices; and the manufacture in these lines has fortunately passed into the hands of some extensive and well-equipped manufacturers, who will push and develop the trade in co-operation with the gas companies, and do away with the heretofore existing lethargy which has prevailed, while all cooking and other consuming appliances were subsidiary to the meter trade.

To show with some reasonable certainty that this branch of the trade is gaining ground most rapidly, we append the following table from our special reports showing the percentage of gas output now being sold by the stated companies for fuel purposes: Columbus, Ohio, 20 per cent.; Fitchburg, Mass., 20; New Bedford, Mass., 20; Zanesville, Ohio, 16; Newark, N.J., 15; Birmingham, Conn., 15; Poughkeepsie, N. Y., 15; Portsmouth, Ohio, 14; Waterbury, Conn., 11; Delaware, Ohio, 10; Vincennes, Ind., 10; Wellington, Kan., 10; Sandusky, Ohio, 10; Cedar Rapids, Ia., 20; Spencer, Mass., 33; Palatka, Fla., 13.

There are many towns throughout the country in which 5 to 15 per cent. of the total sale of gas is for fuel uses; and what can be accomplished in this direction in either of the localities mentioned above can be duplicated in others, and both will be susceptible of marked improvement. As a matter of fact, the only localities in which a restricted use of gas for fuel will be found are those situated over coal beds or in heavily wooded sections, where fuel costs nothing; and we are not so sure but the convenience of gas will in time win its way even among these favoured few.

Far-sighted gas managers entertain one opinion on the subject of gas for fuel; and it is that the day is close at hand when an exceedingly important feature of every gas company's business will be the sales of "day gas." Concessions in price have been made, and will continue to be made, for such consumption. But all first-class companies are in a position to meet the demand from this source; and any modern gas plant can send out as day consumption double its present output with a comparatively small outlay for additional apparatus. In this connection, it may be of interest to state that the introduction of the gas-engine is constantly increasing. Thousands of small power users are now employing these motors, and realize the convenience and economy of so doing. But it is not alone in small powers that the gas-engine has its advantages; for we find gas motors of 100-horse power are being built and erected for various purposes. Not so many years will pass ere the gas and electric motors will have made serious inroads on steam power which has brought in its train a centralization of operatives, closely quartered in ill-ventilated structures, detrimental to health and comfort. This may all be changed by the introduction of gas motors into the home of the artizan, where each family can have its workshop fitted up to the requirement of its special life work.

In the report of the Massachusetts Board, we find a paragraph on this subject in connection with remarks on the growth of the business, which reads: "There is also much time and study given at present to the question of fuel gas. . . . Many writers on the use of gas for fuel believe that illuminating gas can be used to better advantage for domestic purposes, owing to its greater heating qualities and the convenience of having but one set of distributing pipes."

One can seldom visit an American city without having pointed out one or more men who have amassed fortunes out of the local gas-works; and some of our wealthiest and most careful investors have long sought after gas securities as their first preference for investment. Take the case of I. V. Williamson, of Philadelphia, who was at the time of his death one of the richest men in the country. He had long been known as a hunter for gas stocks; and when his executors took hold of his estate, they found over $1,000,000 worth of gas stocks and bonds. Hon. John Wanamaker has long regarded gas securities as among the most desirable class of holdings; and it is believed that he owns several hundred thousand dollars' worth of gas stocks. In fact, all of the solid men of Philadelphia have more or less sums in gas securities; and the same may be said of New York, Boston, Chicago, and St. Louis capitalists. In England, gas shares and gas undertakings have long been considered the safest and most desirable kind of investment; and the development of the business in America will certainly stimulate new and increasingly heavy investments in the securities of gas plants.

THE ELECTRIC LIGHTING MOVEMENT AT BROMLEY.

The Comparative Cost of Gas and Electricity.

In the JOURNAL for the 17th ult., we gave some calculations made by a correspondent of a Bromley newspaper as to the comparative cost of gas and electric lighting in the town. The figures, it may be remembered, were published with the view of combating certain statements made by the representative of the firm who are endeavouring to obtain a contract for the introduction of an electric light undertaking in Bromley; and they have had the support of Mr. Denny Lane, as shown by his letter in our last issue. The electrician has not been silenced by his opponent, but rather stimulated to renewed effort, the result of which appears in a long letter to the paper which gave publicity to the figures of the "other party" who claimed a hearing. In fairness, we reproduce the principal portions of the letter.

The writer begins by reiterating his previous statement that the electric light, even with the incandescent system, is cheaper than gas. This he proceeds to show in the following way: "A 16 nominal candle power lamp, when run at 100 volts, takes 0·6 ampere; thus 100 × 0·6 = 60 watts. This lamp, photometrically and usefully, is equal to 2·16 gas-jets consuming 5½ cubic feet of gas per hour. If we divide 60 by the actual candle power, we find that 2·30 watts are absorbed for every candle. The Board of Trade unit is 1000 watts; and thus 1000 divided by 2·30 gives 434 candles as being the resultant from one Board of Trade unit. Bromley gas, with ordinary burners, gives an illumination of 2·4 candles per foot of gas consumed. Thus with a consumption of 1000 cubic feet, you get 2400 candles; so that I may fairly state that 1000 cubic feet of Bromley gas is equal to about 5·53 Board of Trade units, and not 11 as assumed by *Audi alteram Partem*. 5·53 Board of Trade units, at 6d. per unit (the price charged in every instance where the Thomson-Houston system is used), come to 2s. 9d., and 100 cubic feet of Bromley gas to 3s.—showing an advantage in favour of the electric lighting of 3d." The writer then deals with the comparisons of the retail cost of electricity and gas. Taking first the annual expense of an installation of 50 incandescent lamps each equal to 2·16 gas-jets, he produces the following statement: 50 lamps each burning 14,000 hours, absorbing 60 watts per hour, at 6d. per 1000 watts, £100; 50 new lamps, at 4s. each, £10; meter-rent, 7s. 6d.; convertor, £1; main fuse, 5s.—total, £116 12s. 6d. To replace these 50 lamps, 108 gas-jets would, he says, be required. These would cost, at 5½ cubic feet per hour for 1400 hours, £124 14s. 9d.; meter-rent would come to 16s.—making £125 10s. 9d. This shows a balance of £8 2s. 3d. in favour of the electric light. Dealing next with the special case of the tradesman in the town who, he had previously stated, would effect a saving of £60 per annum by the adoption of the electric light, the writer now makes out that the cost of illuminating his premises by that system, using two arc and 70 incandescent lamps, would be £119, as against £132 by gas—a difference of £13, with, he maintains, an increased light of upwards of a million candles. Another correspondent points out, however, that the figure taken by the electrician for his gas calculation in this case is too low by 3d.; the price of gas at Bromley being 3s. 3d. per 1000 cubic feet. This brings the figure of £132 up to £142 18s.; making the difference £23 18s., or really (deducting £2 for the meter) £21 18s.

At the last meeting of the Bromley Local Board, a letter was received from Messrs. Laing, Wharton, and Down, notifying their intention to apply for a Provisional Order, either on behalf of themselves or of a local company to be incorporated, for the lighting of the district by electricity. On the same occasion, a letter was received from Mr. H. J. Lansbury, furnishing the particulars of the proposals of the gentlemen who are about to form an Electric Lighting Syndicate for Bromley, which were asked for at the previous meeting of the Board. Both letters were referred to a Committee of the entire Board.

The "Hunter Compact."—The Corporation of Salford were evidently satisfied with the result of their action against Mr. Ellis Lever at the recent Leeds Assizes (the verdict in which case was reviewed in the judgment delivered last Saturday week by a Divisional Court of the Queen's Bench Division of the High Court of Justice), inasmuch as it appears, from a letter written by the Solicitors of the Lancashire and Yorkshire Bank, that on May 13 the securities received by them from Alderman Dickins and Mr. J. C. Walker, to guarantee the Corporation recovering £10,000, were returned to these gentlemen at their request.

METROPOLITAN WATER COMPANIES' CHARGES.

Mr. Causton's Bill.

The Bill introduced by Mr. Causton and the other Metropolitan members on the 9th ult., to regulate the charges of the London Water Companies, was issued last Wednesday. It proposes to suspend the increase of water-rates in London that will be authorized by reason merely of any increase in value that may be made in the forthcoming quinquennial valuation of property. It is suggested that, for water-rate purposes, the present valuation rate on any tenement shall be declared to be in general a maximum, and that no increase thereon shall be lawful except for equitable reasons. The reasons specified for permitting an increase are: (1) That there is a larger use of water for or on the tenement; (2) that the cost to the water company of supplying water thereto has increased; (3) that the person from whom such increased amount is demanded has, for good consideration, entered into a written contract to pay it. In every case of an increased demand for any of these reasons, the demand-note is required to contain a statement of the preceding demand and of the increase proposed, and also of the reasons alleged for it. The jurisdiction over these increased demands is placed in the County Court. If any increase shall be sued for in a County Court on the ground of larger use, the proof of the due delivery of the demand-note is to be *primâ facie* evidence that the amount of the increase is due; but it will be lawful for the person disputing it to show that he is not liable by contract, and either that the alleged reasons are partly or wholly incorrect, or that the proposed increase is disproportionate to the actual increase in use. If the increase is demanded on the ground of increased cost of supply, then if such cost is alleged by means of any change in the tenement itself, the preceding provisions are to apply. If otherwise, the onus of proving such increase shall be on the water company; and any County Court Judge shall be entitled to stay all actions which, in his opinion, will be governed by any one case until that case has been finally decided. The Judge is in every case to have power, after hearing both parties, to make an absolute order for payment of the amount of the proposed increase, or for such less amount as he may think just; but it is provided that in no case shall the company be entitled to recover from any person a greater amount by way of water-rate than the amount which they would have been entitled to recover if the Act (which is to be cited as the Water-Rates Amendment Act, 1890) had not been passed.

The Lancashire Coal Trade.—Business continues quiet in the coal trade; but, considering the time of the year, the market is very steady in tone. Quotations for all descriptions of fuel remain practically unchanged, although easier rates are obtainable in several quarters where a lessening of large stocks is desired. Coke still commands a good price, and sells freely. The best descriptions are quoted at 18s. and 19s., and inferior kinds anywhere between 12s. and 15s. per ton. In coal, the better qualities for house purposes average about 11s. to 11s. 6d. per ton; and seconds, 10s. to 10s. 6d. Commoner kinds sell freely at 8s. 6d. to 9s. at the pit's mouth; burgy fetching 7s. to 7s. 6d., with 6s. 6d. for commoner sorts. Steam coal is obtainable at about 9s. 6d. per ton delivered, and the demand is fairly good inland, with shipping trade slow.

New Joint-Stock Companies.—The Thetford Electric Light and Power Company, Limited, has been registered with a capital of £5000, in £10 shares, to carry on the business of electricians, mechanical engineers, &c. The Oldbury Alkali Company, Limited, is an undertaking just started, with a capital of £360,000, in £100 shares, to carry into effect an agreement entered into on the 21st ult. to acquire the business of Messrs. Chance Bros., the well-known alkali makers and chemical manufacturers, of Oldbury. Among the new joint-stock undertakings lately registered, we may mention electric lighting companies for the following districts: Bristol, Camberwell and Islington, Canterbury, Cardiff, Chelsea and Belgravia, Devonshire, East Coast towns, Henley, Ipswich, Kidderminster, Loughborough, Manchester, Northern Counties, Paddington and Bayswater, Penzance, Stamford Hill, Tottenham and Edmonton, Weston-super-Mare, Weymouth, and Woolwich.

Increase in the Price of Gas at Oldham.—At last Wednesday's meeting of the Oldham Town Council, Mr. S. R. Platt, the Chairman of the Gas Committee, made a statement respecting a proposal to increase the price of gas by 2d. per 1000 cubic feet. He observed that the Committee's expenditure during the current year would be considerably increased. The advance in the price of coal and cannel would make a difference of £12,762; stokers' wages would entail an increased expenditure of £4115; repairing a gasholder at Higginshaw, £1000; increase of yard and street men's wages, £500; and expenditure at Higginshaw on the new gasholder (capitalized), about £1500. These gave a total extraordinary expenditure of £19,877. The increased cost of coal alone was 3·662d. per 1000 cubic feet; and stokers' wages, 1¼d. The Committee considered that this expenditure warranted them in advancing the price of gas by 2d. per 1000 cubic feet, which would increase the income by £19,641.

Burnley Corporation Gas Supply—In last Tuesday's JOURNAL we announced that, at a private meeting of the Burnley Corporation, it was resolved to reduce the price of gas to 2s. 1d. per 1000 cubic feet, within the borough, and to 3s. 4d. outside; also to reduce the meter-rents two-thirds of the present charges; and abolish deposits. At the monthly meeting of the Council held last Wednesday, the resolutions were confirmed. In moving the confirmation of the special resolutions relating to the reductions, Alderman Collinge, Chairman of the Gas Committee, said that the Committee intended to make a thorough canvass of the town after next winter, with a view to inducing all those who did not use gas to become consumers. Referring to the agitation for a further reduction in the price of gas to outside consumers, he said the Committee had decided to favourably consider the matter at the end of the present financial year. The Corporation only charged outsiders the same rate as was in force at Blackburn and Accrington.

THE INQUIRY INTO THE WATER SUPPLY OF THE CITY OF LONDON.

The Committee appointed by the Corporation of London to inquire into the question of the water supply of the City, whose proceedings have already been recorded in the JOURNAL (see our previous volume, pp. 1083, 1194), met again at the Guildhall on Monday, the 23rd ult., under the presidency of Sir GUYER HUNTER, K.C.M.G., M.P.

Mr. *W. Cooke*, of the firm of Messrs. Cooke and Sons, carpet manufacturers, of Friday Street, was the first witness. He stated that in March, 1886, there was an increase in the charges made by the New River Company amounting to double. This was not because there was any extra consumption of water; and he did not doubt that the object was to augment the revenue of the Company. The rise was from £12 to £24. With regard to other property in which he was interested, the increase in the charges was from £6 16s. 3d. to £13 14s. 4d. He wrote to the New River Company; but they did not reduce their charges in the first instance, and he called a meeting of people who had suffered in the same way. Proceedings were taken against the Company as a test. [Witness gave an account of these proceedings, which were fully reported in the JOURNAL in their various stages.] Practically the supply of water was a monopoly. He had an opportunity of making inquiries into the question of the charges levied by the New River Company, and he had been very much struck with their irregularity. He could give an instance of it in respect to No. 2, Angel Court, the rateable value of which was £324, and the charge made upon it by the Company was £9 10s. 4d.; while in the case of another property (the address of which he would prefer not to give), which was not 100 yards distant, rated at £1000, the charge was £10. That property was three times the value of the other, yet the charge was only 10s. more. He had also tested the quantity of water supplied at Angel Court, and the consumption was found to be considerably less than 20,000 gallons per annum. This was at the rate of about 12s. per 1000 gallons.

Mr. *Jabez Hogg*, M.R.C.S., said he looked upon the water supply of London as a very improper and inadequate one; and it was purely on the ground of public health that he appeared before the Committee. The question of the water supply of the Metropolis was one he had studied for many years; and he considered the City had been very hardly treated in this matter—the water supply having been indifferent and improper. The supply of water was a measure of the health of the people; and whenever the supply was improved, there was a falling off in the death-rate. He held that the Water Companies had not, by any action they had taken, justified an increase in their charges; the same state of things that prevailed twelve years ago being in existence now. Although some six or eight years ago the New River Company compelled the whole of the persons living in his neighbourhood to put new fittings to their water systems (it being stated that this was necessary to ensure a constant supply), they had not received an increased, but rather a diminished supply. The water was very hard, and spoilt boilers and domestic appliances. He calculated that the hardness increased from 8° to 16°, and water to be useful should certainly not exceed 3° or 4° of hardness.

The CHAIRMAN remarked that this hardness in the water was not confined to the New River Company. Was witness's complaint directed against the other Companies?

Witness replied that it was against the whole of the Companies, because it was a matter they had in their own hands. They could diminish the hardness of the water if they liked to use Clark's system, which could be done at a very small expense.

The PRESIDENT said the hardness of the water was not altogether an unmixed evil. Supposing the water was made like distilled water, would it not be injurious, and make it necessary to introduce another system of pipes.

Witness admitted that such water could certainly not be sent through leaden pipes; but this was not likely to happen so far as London was concerned. He contended also that the present supply was inadequate. He thought 35 gallons per head per day would be sufficient. With regard to the charge, he said a sliding scale was in force in Birmingham, where it had been adopted because of the objections to the supply of water by meter. He believed that the system had been successful, and that since its introduction the supply had been much improved, and the cost reduced by something like 25 per cent. Other towns had experienced similar improvement. He thought if this could be introduced in the Metropolis, it would tend greatly to the benefit of the health of a city like London.

The PRESIDENT asked Mr. Hogg if he was of opinion that the water supply would be much improved by its being placed in the hands of a public body.

Witness thought it would undoubtedly; and it would be an advantage in other ways. The Companies had always been able to have their grievances remedied by Acts of Parliament, while the consumers had never been represented properly; so that all the Acts that had been passed had been for the benefit of the Companies. Water was the most important element of life; and it could not but be injurious when its supply was only in the hands of private companies. It was highly essential that it should be in the hands of a public body.

Mr. *H. Wilkins*, Clerk to the Vestry of St. James's, Piccadilly, produced a series of resolutions which had been adopted by that Vestry, the members of which, in conjunction with other Vestries (see JOURNAL for June 24, p. 1196), had just assembled in conference upon the water supply of London. At that conference a report was presented dealing fully with the whole question, and ending with the following conclusions:

(1) That the time has arrived when the supply of water to London should be placed in the hands of a public representative body, such as the London County Council.

(2) That the best means of effecting this object is for the existing water undertakings to be transferred to such public representative body.

(3) That anything approaching the terms proposed by Mr. E. J. Smith in 1880 is "not a satisfactory or admissible basis of purchase."

(4) That, upon present information, the most equitable mode of assessing the value of the undertakings appears to be a calculation upon the profits either of the last completed year, after allowing for any extraordinary

receipts or expenditure during such year, or the average of the last three years.

(5) That the purchase-money should be paid in the form of stock in preference to cash.

(6) That taking the Birmingham Water-Works as a guide, the purchase of the water undertakings ought to be accomplished at a price less than, or not greatly exceeding, £28,000,000.

(7) That the London County Council should be authorized by Parliament to negotiate with the several Water Companies for the purchase of their undertakings, with power to establish an independent, or competing, or additional supply either in the whole or any portion of a district now supplied by a Water Company.

Mr. ROSE-INNES said there was one matter to which he must draw witness's attention—viz., that there must be someone responsible to the ratepayers for the water supply. Whether it was to be conducted by two or three bodies was an open question. He also pointed out that as something approaching £28,000,000 would be involved, someone must be paid to carry out the great amount of work attached to such an undertaking, because there were about 230 members of the Corporation, and they sometimes felt themselves overworked.

Witness suggested that the work should be done by a Water Trust. This, he believed, was the idea of the Parliamentary Committee of his Vestry. He thought perhaps it would be better that the supply should be in the hands of some other body than the London County Council.

Mr. *S. Wood*, a member of the firm of Messrs. Alfred Lass and Co., Chartered Accountants, of Gracechurch Street, who had given evidence at previous sittings of the Committee, was recalled, and produced additional statistics. Questioned by the PRESIDENT thereon, he said: Since the last meeting of the Committee, I have continued the calculations from 1885 down to 1888-9; comparing the annuities which would have been payable on the 3½ per cent. water stock, ordinary and deferred, with the profits which have actually been earned by the eight Metropolitan Water Companies. The total profits during the nine years from 1880-1 to 1888-9 inclusive—that is the income from water-rates, &c., less working expenses and *plus* interest on moneys deposited—have amounted to £9,286,830. Deducting interest and annuities which would have been payable during the nine years—viz., interest on preference and debenture stock in existence at the date of the proposed purchase, £1,275,561; and annuities on the ordinary and deferred 3½ per cent. water stock, £8,080,992 (together, £9,356,553)—there would have been a deficiency of £69,723 at the end of nine years. But during these nine years the Companies have raised additional capital, consisting of shares, loans, and premiums, amounting to £2,237,425. This amount, if it had been raised at par at 3 per cent. would have required interest during the nine years to the extent of £295,584; thus increasing the deficiency to £365,307. It is more than probable, however, that under one consolidated management a much smaller expenditure of capital would have been necessary, and also that the working expenses would have been much less. During the nine years, the management of the eight Companies, independently of maintenance of works, has cost roundly £1,168,000, made up as follows:—

Directors' fees	£215,000
Auditors' fees	6,000
Salaries of secretaries, accountants, and office clerks	242,000
Superannuation	72,000
Collectors	396,000
Stationery, printing, and general establishment charges	144,000
Law and parliamentary expenses, &c.	81,000
Official auditor and water examiner	12,000
Total	£1,168,000

In my previous evidence, I stated that the purchasing authority would have gained about £15,000 during the first five years. I have now continued the calculation for nine years down to 1888-9, showing, as I have said, a deficiency of about £365,000. This deficiency has arisen since 1885, and it is partly attributable to the amended basis of charges for water supply—viz., from gross to net annual value—and to the check caused thereby in the increase of the Companies' receipts. In 1885 the Water-Rate Definition Act was passed, which finally settled the basis of the charge for water on the net rateable value; and, in my evidence at the last meeting of the Committee, it was shown that the gross receipts for water-rents during the years 1884 and 1885 remained practically at the same amount instead of increasing at the normal rate of increase. The Companies' water-rental increased during the period of nine years at the average rate of 2·29 per cent. per annum. The annuities payable under the 1880 scheme amounted in 1880 to £773,454 per annum, and, with the additions of deferred stock, to £1,027,098 in 1888—an increase of £253,644, or at the average annual rate of 3·61 per cent. There were to be no more additions to the deferred stock after 1892, from which date, other things being equal, the income would begin to overtake the annuities. The deficiency of £365,307 during the nine years is shown as follows:—

In 1880-81 there would have been a deficiency of		£9,220	
,, 1881-82	,, ,, gain of		£3,771
,, 1882-83	,, ,, ,,		13,986
,, 1883-84	,, ,, ,,		24,058
,, 1884-85	,, ,, deficiency of	18,070	
,, 1885-86	,, ,, ,,	69,647	
,, 1886-87	,, ,, ,,	75,684	
,, 1887-88	,, ,, ,,	108,615	
,, 1888-89	,, ,, ,,	125,886	
		£407,122	£41,815
Showing for the nine years a net deficiency of		£365,307	

But this deficiency, as I have pointed out, is subject to allowance for the reduced amount of capital and of expenses which would have been incurred under consolidated management. [At the previous meeting of the Committee, some questions were put to witness as to laying communication pipes and charging for them; also as to how rates are recoverable from an occupier who may have absconded without paying. These matters he now fully explained.] With regard to the reduction of water-rates, the Water-Works Clauses Act, 1847, makes provision, in section 80, for the investigation of a water company's accounts (by arrangements similar to those under the General Gas Act), whereby, if it is proved that the company has paid the statutory dividends and made up its reserved fund, any balance of accumulated profit may be applied to the reduction of the water-rates. The Government Auditor, under the Metropolis Water Act, 1871, Mr. Allen Stoneham (who certifies each half year the amount of revenue applicable to dividends), called attention to this point in the case of the West Middlesex Water Company in his report for the year 1887. He wrote as follows:—

An examination of the accounts of the Company shows that the sum needed to make up the deficiencies of any previous dividend since the date of the incorporation of the Act of 1847 was £128,295 5s. 10d., and that in liquidation of this obligation the Company has paid to its shareholders the sum of £128,287 17s. 11d.; leaving a balance of £7 7s. 11d. payable in respect of what are commonly known as back dividends. Section 76 of the Water-Works Clauses Act provides that if the profits of any year amount to a larger sum than is sufficient, after making up any deficiency in back dividends, to make a dividend at the prescribed rate, the excess shall be invested to form a reserve fund of the prescribed amount. The Company, by their Private Act of 1852, section 8, were authorized to form a reserve fund of £20,000; and this having been done, the powers under the section have been exhausted. I am bound to add that, while the Directors do not concur in the view I now express, that back dividends are not payable in respect of periods antecedent to the incorporation of the Act of 1847, they, in view of the profits made by the Company being in excess of the sum necessary to provide for payment of dividends at 10 per cent. per annum, have reduced their charges to the consumer, although section 80 of the Incorporated Act, which provides a means for a rateable reduction to be made in the price of water when the profits are more than the amount prescribed, has not been resorted to.

In the evidence given in connection with the Water-Works Purchase Bill of 1880, the total amount claimed by the London Water Companies for back dividends was nearly 20 millions. Of this sum, the West Middlesex Company have already received, according to Mr. Stoneham, £128,000. With reference to water-works in the hands of local authorities, a return was made to Parliament in June, 1888, respecting the water undertakings of some of the large provincial towns and cities. Each local authority is compelled to pay off the money borrowed for purchase or extensions by sinking fund, or by annual payments of interest and principal; and thus they pay off the capital out of the profits. The return shows (*inter alia*) that for the year 1887, the following corporations paid large sums in redemption of capital out of the profits of the water supply for that year, and in nearly every case carried forward a large surplus. Bradford paid for interest and principal £92,395; leaving a deficiency of £173. Leeds, £69,690; leaving a surplus of £4293. Huddersfield, £32,800, leaving a surplus of £982. Kingston-upon-Hull, £9798; transferred to the borough fund, £2524; and carried forward a surplus of £6867. Nottingham paid for interest, £34,426; for sinking fund, £4013 (together, £38,439); leaving a surplus of £2845. Leicester paid for interest and principal £21,080, and carried forward a surplus of £8518. Blackburn paid £28,867, and left a deficiency of £3276. Bolton paid £26,932, and carried forward a surplus of £10,000. Oldham paid £30,922, and carried forward £6659. I cannot distinguish between principal and interest in all cases, because the annual instalments would include principal and interest; but, of course, a considerable amount of these instalments would consist of principal. Preston paid for interest and principal £13,225, and carried forward a surplus of £1702. Manchester paid £157,506, and carried forward £9634. Liverpool paid £144,778, and left a deficiency of £8342 (Liverpool had been constructing new water-works). Edinburgh paid for interest, £48,825; for sinking fund, £9232 (together, £58,057); and carried forward a surplus of £2578. Glasgow paid for interest £76,098; for sinking fund, £37,625 (together, £113,723); and carried forward a surplus of £3812. Dundee paid for interest and principal £32,316, and carried forward a surplus of £1758. With regard to the desirability of placing the water supply in the hands of local authorities, the Public Health Acts, 1875 and 1878, have empowered local authorities to supply water to their districts, and also to enforce a supply of water when they find that any house in their district is without a proper supply, and also make it the duty of rural sanitary authorities to see that every house has an available and sufficient supply of wholesome water.

The PRESIDENT: Then that really would tend to empower the local authorities to see that the poor have a proper supply of water. We have had evidence that there was the danger of the poor getting an improper supply; but, if this was acted upon, it would be the duty of the local authority to see the poor had a proper supply of water?

Mr. HORA: Then that would tend to show that at present the Companies have not a monopoly in any district according to the Act; they can have no monopoly.

Witness: No; it is generally understood that the London Water Companies have no monopoly in the Metropolis.

The PRESIDENT: You were requested on the last occasion to supplement your evidence by a comparative statement of water-rates and extra charges on domestic houses of the annual value of £50, £100, £200, and £300 in each of the London Water Companies' districts.

Witness: I have prepared such a statement. [Handed in.] The charges for domestic supply, including one water-closet, are as follows in the respective districts:—

	£50 House.	£100 House.	£200 House.	£300 House.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Chelsea	2 4 0	4 6 0	8 8 0	9 10 0
East London	2 14 0	5 6 0	10 8 0	15 8 0
Grand Junction	2 4 0	4 6 0	8 8 0	9 10 0
Kent	2 10 0	4 0 0	8 0 0	12 0 0
Lambeth	3 17 0	6 5 0	11 0 0	16 0 0
New River	2 4 0	4 6 0	8 8 0	9 10 0
Southwark and Vauxhall	2 14 0	5 6 0	10 8 0	15 10 0
West Middlesex	2 4 0	4 6 0	8 8 0	9 10 0

Questioned on the figures in his statement, witness showed generally that the cost of the water supply was higher in the East than in the West of London.

The inquiry was then adjourned till last Thursday, when Mr. Allen Stoneham (the Official Auditor under the Metropolis Water Act, 1871) attended, by direction of the President of the Local Government Board; and gave evidence as to the financial position of the Water Companies; the other witnesses called being Mr. G. Walter and Sir W. J. Farrer. The inquiry was adjourned *sine die*.

NOTES FROM SCOTLAND.

From our Edinburgh Correspondent.

EDINBURGH, *Saturday*.

As I foreshadowed last week, there was something of a breeze at the Edinburgh and Leith Gas Commissioners' meeting on Monday over the publication of the accounts. This is the second year in succession that the accounts have been given out in what the other members consider is a surreptitious manner, and, it is said, by the same person. His identity is well enough known; and no later than this afternoon, a gentleman who is in the Commission, and who was present on Monday, said to me that the suspected one took part in the discussion on that day. The members look upon it as degrading to themselves that a document which is sent to a few in proof for perusal prior to its being submitted to the Finance Committee, should be handed to a newspaper for publication, seeing that the Committee might have alterations to make upon it. As a matter of fact, on this occasion alterations have been made which, though not affecting the result, do affect one view which an outsider might take of the Commissioners' method of financing. Nothing can be said against journalistic enterprise, and any newspaper is entitled to publish all that it can lay its hands upon in an honourable way; but Mr. Macnaughton was right in his remark that no editor of a paper should publish a document which is marked "private and confidential." Besides the Commissioners, the officials in charge of the accounts feel very deeply that the result of their labours should be made known broadcast before they are communicated to the Commission; and this feeling is heightened by the circumstance that it places them in the invidious position of being possibly blamed for making the communication for a consideration, though I may say that no such suspicion does exist. Only three gentlemen in the office had seen the completed accounts, or knew the figures; and if any of them should be suspected, I am certain that the united press of Edinburgh, including myself as your representative, would exonerate them from any such charge. There are members of the Finance Committee who are too honourable to communicate the accounts before their completion, and among others may be mentioned Mr. Colston, who stated in Committee that he was waited upon after he received his proof copy by a representative of a newspaper, but that he declined to show the accounts. Perhaps the gentleman who communicated the accounts is sorry now that he did it, for at the Commission meeting he took no step to vindicate his position. But, whether sorry or not, he must be convinced that he committed a grave misdemeanour, if on no other ground, because he violated the feeling which was given vent to at last year's discussion of the same subject in the remark that it "need not occur again." It has occurred again; and perhaps the best preventative of a recurrence would be that the Commissioners should see that the gentleman does not sit on the Finance Committee for another year.

Regarding the accounts themselves, I have nothing further to add to what I wrote last week than to say that my surmise as to the payment for the extensions at the Edinburgh works was correct. The extensions are not yet completed. When they were started, Mr. R. Mitchell, the Engineer, submitted a scheme which showed an estimated outlay of over £20,000. It was then resolved to go in for only a portion of the scheme, which would cost about £15,000. Since then it has been resolved to complete the scheme; and the contract for the erection of the last bench of retorts has just been let. Meantime, the Commissioners have entered no part of the payment for the completed portion in their accounts. When completed, the whole will be taken out of the reserve fund, which is at present £27,697, and which will thereby be reduced to less than £7000. As the Commissioners have made payments to the contractors on account of their claims, it may be a question whether their financing on this question is on the proper line, or whether it would not have been better to have entered the outlays in the present accounts as against the revenue for the year. Of course, that would have taken away all their surplus, and something more; and the method they have adopted gives the present accounts a more respectable appearance.

As to the meeting itself, besides the discussion on the publication of the accounts, there was little business of consequence. The Engineers' reports for the month of May showed the output of gas to have been: From the Edinburgh works, 46,682,000 cubic feet, an increase of 5,308,000 cubic feet over the output of May, 1889; from the Leith works, 19,831,000 cubic feet, a decrease of 215,000 cubic feet. The number of retorts in use in the Edinburgh works was 197, as compared with 166 in May of last year; and in the Leith works 71, as compared with 72. The Works Committee minute stated that a meeting of the Committee was held in London on the 13th ult., at which the contract for the erection of a new retort-bench at the New Street works was let to Messrs. Hanna, Donald, and Wilson, of Glasgow. The meeting was held in London because the matter was urgent, and a quorum of the Committee did not attend in Edinburgh when a meeting was summoned on the 10th ult. At a subsequent meeting of the Committee in Edinburgh on the 21st ult., Bailie Steel moved that the action of the Commissioners in London, being illegal and unnecessary, be not approved of; but his motion was lost, only himself and Mr. Macnaughton voting, for it. The Commissioners approved the action of the Committee in London. The Finance Committee reported that they had considered the balance-sheet for the year to May 15, and had delayed deciding as to how the surplus should be disposed of until they learned from the Engineers the estimated increase in working expenses of the current over last year. On the motion of the Chairman, seconded by Bailie Walcot, authority was given to the Committee to procure that information. The same Committee reported that the revenue from gas for the year from May 15, 1888, to May 15, 1889, was £197,616 13s. 9d., an increase of £7869 19s. over the previous year's rental.

Before passing from this subject, I feel tempted to say that the Edinburgh and Leith Gas Commissioners do not quite know how to manage their affairs. With such a fine business as theirs, a little blowing of their own trumpet would be excusable; but even although it should not go so far as that, a business of so much vitality would stand to be talked about, and if the progress it is making were explained to the public, nothing but good could come of it. It was left, however, to the *Edinburgh Evening News* of Tuesday to inform the public what the progress during the year had been. The writer there, proceeding upon the returns furnished to the Commission, brought out that the output of gas rose during the year from 1,228,055,000 to 1,276,100,000 cubic feet, an increase of 48,045,000 cubic feet, representing an increased revenue, less discount, abatements for public lamps, &c., of about £8000.

Mr. John M'Crae, the Gas Engineer in Dundee, has made up a valuation of the works and plant belonging to the Commission, which shows a total of about £260,000. Whereupon the *Dundee Advertiser* concludes that, as the indebtedness of the Commission to the public is stated at about £360,000, "of the amount paid for goodwill by the Gas Commissioners to the Gas Company, about £100,000 still remains to be wiped off;" and the editor thinks the "fact is not a pleasant one upon the face of it," and that "what it suggests is that the sinking fund, though it already requires an addition to the price of gas of about 4d. per 1000 cubic feet, is not large enough to meet the demands of prudent management." I am sure that Mr. M'Crae, when he made up his valuation, did not intend that such a construction should be put upon it. It is true that the debt incurred to the Gas Companies is still in great part to wipe off; but it is no larger than it would have been to the shareholders of the Companies had they continued in existence. Compared with what it was when the transfer took place, the indebtedness of the Commission is at present more than double; but the outlays which have raised the debt to what it is have led to the business being more than doubled, so that the Commissioners stand in, if anything, a more favourable position than the Companies did. The fact is that the return last year upon what may be called a capital of £360,000, was £75,415, which is at the rate of 20 per cent., a result which is very far from meriting the statement that it "is not a pleasant one upon the face of it." The Editor is evidently on the look-out for a text to preach upon when the dull times come.

The Dundee Water Commission, at a meeting on Thursday, approved of the accounts for the past year and the estimates for the current year, and agreed to reduce the domestic water-rate from 1s. 1d. to 1s. per £1. This is the third year in succession in which a reduction of 1d. per £1 on the domestic rate has been made. The other rates were maintained at the same figure; but it was resolved to reduce the charge for meters by one-half.

At the same meeting a claim was made on behalf of the Tayport Gas Company upon the Commission, for a sum of £75 in respect of damage to the Company's pipes and loss of gas while the water-pipes were being laid in the town. The claim was considered a large one; and it was sent to a Committee to be considered.

It has been resolved that the new water-works at Falkirk are to be opened on Tuesday, the 29th inst., by the Duchess of Montrose.

From our Glasgow Correspondent.

GLASGOW, *Saturday*.

A hitch of a somewhat serious character has arisen between the Glasgow Gas Committee and the Partick, Hillhead, and Maryhill Gas Company. On the 11th of June, the Finance Sub-Committee had under consideration an application from Mr. John W. Bruce, house proprietor, Hillhead, asking the Corporation to furnish a supply of gas for the houses and stair-jets in some tenements belonging to him. They agreed to grant the same; and, as the Hillhead Police Commissioners were now taking charge of the lighting and extinguishing of the jets in common stairs, it was further agreed that the price for supplying gas for the stair-jets of all persons within that burgh desirous of having such supply from the Corporation should be the same as that charged for similar purposes within the city. Shortly after this decision as to the supply of gas for stair-lighting was communicated to Mr. Bruce (himself one of the Hillhead Burgh Commissioners), he wrote to one of the Glasgow papers announcing that, as the Commissioners would not take any action in the matter he had on his own responsibility, asked the Glasgow Corporation for a quotation for the stair-lighting to the property under his charge in Hillhead, and had arranged with them to supply the gas for the stair-lighting at 10s. per light all the year round, as against 15s. charged by the Maryhill Gas Company. He concluded his letter by saying that, under the circumstances, he thought the ratepayers should take some steps to prevent such a waste of money. Mr. Bruce's letter excited a considerable amount of interest both in Glasgow and in the western suburbs, where the Partick, Hillhead, and Maryhill Company's gas is most in demand. Then came a bombshell of another sort, in the shape of a couple of circulars which were distributed amongst the good people of Hillhead, and of which the following are copies:—

Gentlemen,—As I desire to have a supply of Gas from the Corporation of Glasgow instead of from you, I have to request that you will be good enough to remove your meter from my premises in order that the Corporation's meter may be put in.

I am, yours truly,

_____

To the Partick, Hillhead, and Maryhill Gas Company, Limited, Hillhead.

Sir,—I wish to have a supply of Gas from the Corporation of Glasgow for my house at ; and shall therefore be obliged by your having a meter put in and the necessary connections made as early as possible.

I am, your obedient servant,

_____

To the Treasurer, Glasgow Corporation Gas Department, City Chambers, 45, John Street, Glasgow.

By-and-bye it was reported by the Glasgow Town Clerk, at a meeting of the Corporation Gas Committee, that two actions of suspension and interdict had been instituted in the Court of Session, at the instance of the Partick, Hillhead, and Maryhill Gas Company against the Corporation, in connection with the work that was being done for the purpose of supplying the houses and stair-jets in properties in Hillhead belonging to Mr. John W. Bruce with Corporation gas. After giving the matter some consideration, the Committee instructed the Town Clerk to take the necessary steps for defending the actions. It will thus be seen that there is brewing quite a storm between the Glasgow

Gas Trust and the Suburban Gas Company, a sort of "war to the knife." How the matter is to eventuate, it is difficult to say.

The "war to the knife" just spoken of is also taking shape in another direction. For a number of years the Clydebank Division of the Police Burgh, now known by that name, has been supplied with gas by the Glasgow Gas Commissioners, at the same rate as that charged within the city and the immediate suburbs. In Dalmuir, which is another division of the Burgh of Clydebank, the gas supply has hitherto been obtained from the Dalmuir, Kilpatrick, and Bowling Gas Company, whose works, it may be remembered, lately passed into the hands of the Partick, Hillhead, and Maryhill Gas Company, as mentioned by Mr. James M'Gilchrist, Dumbarton, when that Company's Gas Bill was last before a Parliamentary Committee. For some time there were overtures made to the Glasgow Gas authorities, on behalf of a number of the people of Dalmuir, that they would extend the Glasgow gas-mains from Clydebank into that division of the Police Burgh. The negotiations fell through, *nolens volens*, seeing that the Bowling Gas-Works had been sold to the Gas Company in the western suburbs of Glasgow. Then about the end of May, and again in June, the Clerk to the Police Commissioners of Clydebank wrote to the Glasgow gas authorities on the question of extending their gas-mains into the Dalmuir portion of that burgh. Since the receipt of his two letters, the matter has been deliberated on most carefully, with the result that the Sub-Committee on Works eventually agreed to recommend that the necessary mains should be laid down for supplying Dalmuir with Corporation gas. Without any objection, or even a single remark from any member of the Town Council, at last Thursday's meeting of that body the minute was agreed to.

It has been resolved to open branch offices in connection with the Glasgow gas supply in several of the suburban districts, for the purpose of receiving complaints and giving attention to other matters; and including also the exhibiting and sale or hire of gas-stoves and other cooking and heating apparatus. One of them has actually been opened within the burgh of Partick. All these branch offices are to be connected by telephone with the head office in Glasgow.

Up to May 31, which was the last day of the Glasgow Gas Trust financial year, there had been received in the shape of gas-rents the sum of £295,586 5s. 3d., as compared with £297,414 3s. 10s. in the year 1888-9. These figures show that the past year's gas revenue was £1827 18s. 7d. under that of the year immediately preceding. Against that decrease in the revenue, however, must be put the fact that the price of gas in the past year was 2d. per 1000 cubic feet lower than the price charged in the year 1888-9.

The Glasgow Gas Trust Coal-purchasing Committee have this week made some extensive purchases of coal for the ensuing lighting season. A few interesting details regarding the contracts placed will fall to be mentioned in next week's "Notes." The contracts have been extensively spoken about this week, as they have excited much attention both amongst coal men and gas managers.

The Bothwell and Uddingston Gas Company is one of the most successful of the smaller gas companies in Scotland. Its area of supply takes in two important districts lying about seven or eight miles from Glasgow, and in a great measure residential suburbs of that city. The annual report always marks progress from year to year; and it is assuredly indicated in that just issued for the twelve months ending April 30 last. It shows that, after writing off for depreciation of works and plant, and bad debts, there is a balance at the credit of the revenue account amounting to £1254 15s. 6d. Adding the balance brought forward from last year (£813 15s. 3d.), there is a total amount at the credit of the profit and loss account of £2068 10s. 9d. This the Directors recommend the shareholders to apply in the following way: In payment of a dividend at the rate of 10 per cent. for the year, absorbing £900; and adding to the reserve fund £250—leaving £918 10s. 9d. to be carried forward. During the past year, the quantity of gas sold to the consumers was 18,539,500 cubic feet; being an increase of 756,600 cubic feet over the sales of the preceding year. Including the quantity consumed in the public lamps and at the works, the total consumption was 19,299,500 cubic feet, as against 18,512,900 feet in the year 1888-9. The total quantity of gas manufactured in the past year was 20,699,100 cubic feet (as compared with 19,800,000 cubic feet in the preceding year); so that the loss from leakage, &c., was about 6·7 per cent. (There are exceedingly few places in Scotland where the unaccounted-for gas comes down to this low level.) The amount credited to revenue this year for gas consumed and for meter-rental is £3714 1s. 11d., as against £3736 6s. 11d. in the year 1888-9—the decrease again being accounted for by the further reduction of the selling price of gas made last year. The residual products yielded £470 12s. 9d., as compared with £320 2s. 5d. in the preceding year. The past year's coal, lime, &c., cost £1607 18s. 9d.; the wages and salaries came to £703 15s. 6d.; the gas for the public lamps, together with the lighting and repairs, cost £149 17s. 3d. The total revenue amounted to £4233 os. 2d.; the expenditure to £2763 2s. 8d. So that there was a balance of £1469 17s. 6d. in the shape of profit on working in the year 1889-90, which is carried to profit and loss account; the balance at the credit of which is £2068 10s. 9d., as previously mentioned. Much of the credit of the successful working which brings out such an excellent balance-sheet is due to the Manager, Mr. Laurence Hislop, who has been in the Company's service many years.

This week's pig-iron market has been steady, and Scotch warrants, after being dealt in on Monday at 45s. 4½d. per ton cash, advanced to 46s. 2½d. on Thursday; but closed yesterday a shade easier, with sellers at 45s. 9½d. per ton. A rather better feeling has been shown in trade circles during the week.

The coal trade remains fairly active, but mainly on shipping account, which, however, appears to be threatened in some directions. Main coal is selling at Clyde ports at 8s. 9d. per ton. House coal is in slow demand; the price varying from 7s. 6d. to 9s. per ton at the pit's mouth.

A local report of the Glasgow sulphate of ammonia market for the week ending July 5, 1890, says: This market continues very firm, as much as £11 10s. per ton, usual terms, having been paid for July. Makers in most cases are not very willing to sell even at the above figure; and it is reported that in one case this was refused. £11 12s. 6d. has been paid for forward; and a firmer tone seems to prevail all round.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 5.

Sulphate of Ammonia.—The tendency is considerably stronger; and all parcels offering move off at full prices. Hull is now generally quoted at £11 10s.; Leith and Liverpool, at £11 7s. 6d.; and there will not be any bulk of sulphate on the market for the next month or two; while the dealers' requirements appear to be extensive. Owing to Independence Day, there have been no American orders on the market for two days; but we hear of several inquiries pending, and there is every probability of a further large business. Regarding the Continent, the shipments are fairly large; but Germany is sending no orders for prompt parcels, no doubt because the July to August requirements have been largely intercepted by dealers. France and Spain seem in the market for fair quantities. Nitrate is very steady; and prices are likely to be maintained.

LONDON, *July* 5.

Sulphate of Ammonia.—Sulphate of ammonia is in good demand. The price may be taken at £11 5s. to £11 7s. 6d. for prompt delivery; and £11 10s. for July to Sept.

Tar Products.—Benzoles are still in good request at 2s. 10d. for 50/90 and 3s. 11d. for 90 per cent. A considerable business has been done in carbolic acid, at 2s. per gallon for 62½° to 60°; and there are now no longer sellers at this figure. There has been more inquiry for pitch; and contracts will no doubt soon be largely entered into for next season's shipment. Prices quoted are from 29s. to 30s. Anthracene and creosote remain dull. There has been a fair business done, however, in creosote salts, which should affect the latter article favourably.

Exhibitions of Gas Appliances.—Highly successful exhibitions of cooking and heating appliances have recently been held at Tottenham, Torquay, Sidcup, and Ramsgate, under the auspices of the local Gas Companies. The attendances were large; and the exhibits were supplied by Messrs. Thos. Fletcher and Co., of Warrington.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 83.)

Issue.	Share	When ex-Dividend.	Dividend or Div. & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	16 Apr.	10½	Alliance & Dublin 10 p. c.	10	17—18	..	5 16 8
100,000	10	,,	7½	Do. 7 p. c.	10	12½—13½	..	5 11 1
300,000	100	1 July	5	Australian (Sydney) 5 % Deb.	100	107–109*	..	4 11 9
100,000	20	30 May	8	Bahia, Limited	20	19—21	..	7 12 4
200,000	5	15 May	7½	Bombay, Limited	5	7¼—7¾	..	4 16 8
40,000	5	,,	7½	Do. New	4	4¾—5¼	..	5 17 10
380,000	Stck.	27 Feb.	12½	Brentford Consolidated	100	218—223	..	5 9 10
125,000	,,	,,	9½	Do. New	100	160—165	..	5 12 2
220,000	20	13 Mar.	11	Brighton & Hove Original	20	40—42	..	5 4 9
320,000	20	28 Mar.	11½	British	20	43—45	..	5 0 0
50,000	10	13 Mar.	11	Bromley, Ordinary 10 p. c.	10	18—20	..	5 10 0
39,000	10	,,	8	Do. 7 p. c.	10	13—14	..	5 14 3
328,750	10	13 June	8	Buenos Ayres (New) Limited	10	13—14	—½	5 14 3
200,000	100	1 July	6	Do. 6 p. c. Deb.	100	103–106*	+1	5 13 2
159,000	20	27 Feb.	8	Cagliari, Limited	20	25—27	..	5 18 4
550,000	Stck.	16 Apr.	13½	Commercial, Old Stock	100	252—257	+3	5 7 0
130,000	,,	,,	10½	Do. New do.	100	203—208	..	5 3 4
130,000	,,	27 June	4½	Do. 4½ p. c. Deb. do.	100	117–122*	..	3 13 9
557,320	20	13 June	13	Continental Union, Limited	20	47—49	..	5 6 2
242,680	20	,,	13	Do. New '69 & '72	14	33—35	..	5 4 0
200,000	20	,,	10	Do. 7 p. c. Pref.	20	38—40	..	5 0 0
75,000	Stck.	28 Mar.	10	Crystal Palace District	100	195—205	..	4 17 7
234,060	10	30 Jan.	16†	European, Limited	10	28—30	+1½	5 6 8
120,000	10	,,	26†	Do. New	7½	19—21	+1	5 14 3
354,060	10	,,	16†	Do. do.	5	13¾—14½	+½	5 10 4
5,470,620	Stck.	13 Feb.	13½	Gaslight & Coke, A, Ordinary	100	248—253	+1	5 8 8
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	100—103	..	3 17 8
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	253—258	..	3 17 6
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	121—125	..	4 0 0
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	180—185	..	4 1 1
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	163—167	..	4 3 10
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	253—258	..	3 17 6
1,061,150	,,	13 June	4	Do. 4 p. c. Deb. Stk.	100	115—120	..	3 6 8
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	123—128	..	3 10 4
650,000	,,	,,	6	Do. 6 p. c. do.	100	163—168	..	3 11 5
3,800,000	Stck.	15 May	12	Imperial Continental	100	218—223	..	5 7 7
75,000	5	13 June	6	Malta & Mediterranean, Ltd.	5	5—5¼	..	5 9 1
560,000	100	1 Apr.	5	Met. of Melbourne, 5 p. c. Deb.	100	112—114	..	4 7 9
541,920	20	13 June	6½	Monte Video, Limited	20	20¾—21¼	..	6 0 11
150,000	5	30 May	10	Oriental, Limited	5	8¼—9	..	5 11 1
60,000	5	28 Mar.	7	Ottoman, Limited	5	5¼—6	..	5 16 8
166,870	10	26 July	4	Pará Limited	10	4—5	..	8 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	98—102	..	5 17 8
500,000	100	2 Dec.	6	2nd Do.	100	95—100	..	6 0 0
150,000	10	16 Apr.	10	San Paulo, Limited	10	15—16	..	6 5 0
500,000	Stck.	27 Feb.	13½	South Metropolitan, A Stock	100	270—300	..	4 8 4
1,350,000	,,	,,	11½	Do. B do.	100	235—240	+3	4 15 10
141,500	,,	,,	12	Do. C do.	100	247—252	..	4 15 3
650,000	,,	27 June	5	Do. 5 p. c. Deb. Stk.	100	140–145*	..	3 9 0
60,000	5	27 Feb.	11½	Tottenham & Edm'nton, Orig.	5	11—13	..	4 8 5
				WATER COMPANIES.				
728,446	Stck.	13 June	9½	Chelsea, Ordinary	100	265—270	+5	3 10 4
1,720,560	Stck.	16 Apr.	7½	East London, Ordinary	100	215—219	..	3 8 6
544,440	,,	27 June	4½	Do. 4½ p. c. Deb. Stk.	100	142–147*	..	3 1 2
700,000	50	13 June	9	Grand Junction	50	122—126	..	3 11 5
708,000	Stck.	13 Feb.	10½	Kent	100	275—280	..	3 15 0
1,043,800	100	27 June	9½	Lambeth, 10 p. c. max.	100	250–255*	..	3 14 6
406,200	100	,,	7½	Do. 7½ p. c. max.	100	197–202*	..	3 14 3
200,000	Stck.	28 Mar.	4	Do. 4 p. c. Deb. Stk.	100	122—126	..	3 3 6
500,000	100	13 Feb.	12½	New River, New Shares	100	367—372	..	3 5 2
1,000,000	Stck.	30 Jan.	4	Do. 4 p. c. Deb. Stk	100	127—130	..	3 1 6
902,300	Stck.	13 June	6	S'thwk & V'xhall, 10 p. c. max.	100	170—174	..	3 9 0
126,500	100	,,	6	Do. 7½ p. c. do.	100	158—163	..	3 13 7
1,155,066	Stck	13 June	10	West Middlesex	100	265—270	+5	3 14 1

*Ex.div.

† Next dividend will be at this rate.

GWYNNE & BEALE'S PATENT GAS EXHAUSTERS AND ENGINES.

Telegrams: "GWYNNEGRAM LONDON."

GWYNNE & CO.,

TELEPHONE No. 2698.

HYDRAULIC AND GAS ENGINEERS, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

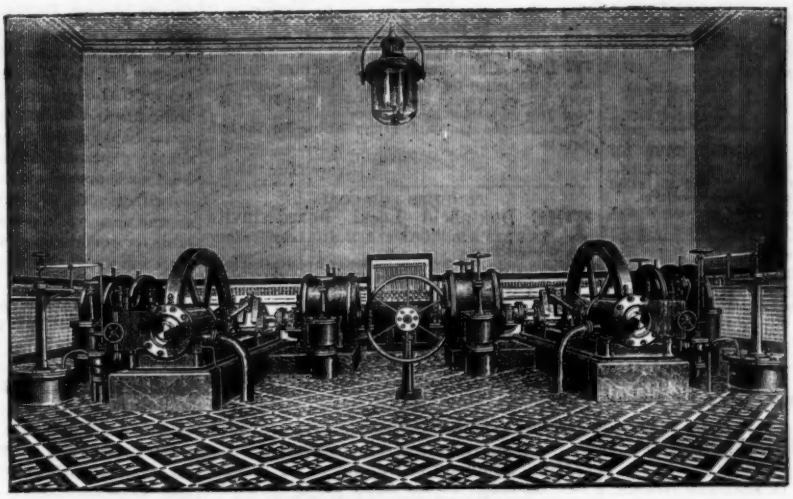
Thirty-three Medals at all the Great International Exhibitions have been awarded to GWYNNE & Co. for Gas Exhausters, &c.

They have never sought to make price the chief consideration, but to produce Machinery of the very highest quality.

The result is that in every instance their work is giving the fullest satisfaction.

They have completed Exhausters to the extent of 28,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work, and can be referred to.

Catalogues and Testimonials on application at the above address.



Only 75 Revolutions per Minute.

The above Engraving shows Two Engines driving Four GWYNNE & CO.'S PATENT NON-FLUCTUATING EXHAUSTERS to pass 200,000 cubic feet per hour (without the slightest oscillation), at the EFFINGHAM STREET GAS-WORKS, SHEFFIELD.

Their Exhausters can be made, when desired, on their New Patent Principle, to pass Gas without the slightest oscillation or variation in pressure.

NO OTHER MAKER CAN DO THIS.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, STEAM-PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage &c.

Also GIRARD and other TURBINES, HIGH-SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAYS.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.

Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

CANNEL COAL, ETC.

JOHN ROMANS & SON, EDINBURGH. Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS AND WATER WORKS.

Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, NEWTON GRANGE, NEAR DALKEITH, } SCOTLAND.

SULPHURIC ACID, B.O.V., for Sulphate of Ammonia Making. Guaranteed clear, of full strength, and to produce a fine white-coloured salt. Delivered in carboys or railway tank waggons.

For prices and terms address BALE, BAKER, AND CO., 120 & 121, Newgate Street, LONDON.

GAS Authorities requiring Second-hand GAS APPARATUS—Mouthpieces, Hydraulic Mains, Condensers, Purifiers, Exhausters, Station Meters, &c. Also superior quality Gas-Purifying BOG ORE (OXIDE OF IRON). Please address, D. M. NELSON AND SONS, 164, St. Vincent Street, GLASGOW. (Telegraphic Address: "GAS GLASGOW.")

EXTRACT from the Harrogate Gas Company's Report, dated the 5th of February, 1890: Coal consumed, 8600 tons. Gas made, 92,880,000 feet; ditto sold, 84,880,000 feet; ditto unaccounted for, 8,000,000 feet; quantity made per ton, 10,800 feet; ditto sold, 9869 feet. Illuminating Power, 16·1 candles. Coals used, Brancepeth. Owners, Strakers and Love, Newcastle-on-Tyne; who have also Brandon Hutton Seam Unscreened Gas Coal. Analysis, 10,500 cubic feet per ton; Illuminating Power, 16·2 candles.

SITUATION Wanted, as leading Stoker. Understands Engines and Exhausters. Well up in Purifying work. Eighteen years' experience. Good references.

Address J. P., 14, Bromell's Buildings, Clapham, LONDON, S.W.

WANTED, by an experienced Man, a Situation as MANAGER or FOREMAN. Has had first-class experience in carbonizing, and understands the general work of a gas-works. Exceedingly good testimonials. Antecedents will bear the strictest investigation.

Apply, by letter, to No. 1838, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, by a young man (aged 29), a situation as MANAGER, FOREMAN, METER INSPECTOR and COLLECTOR, or leading FITTER, of a Gas-Works. Well up in all matters connected with the supply of gas; also interior and exterior fitting. Good references.

Apply, by letter, to No. 1837, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

JAMES LAWRIE & CO. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.

Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & Co., Huddersfield, AND 80, CANNON STREET, LONDON, Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.

*** See Advertisement p. 64 of this week's issue.

Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.

First-Class Award, Melbourne Exhibition, 1880, for Wet and Dry Gas-Meters, Station Meters, and Governors, Pressure-Gauges, Street Lamps, and Pillars, &c.

Telegraphic Address: "Braddock, Oldham."

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of SULPHURIC ACID, from Brimstone, for Sulphate of Ammonia making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol. References given to Gas Companies.

HUTCHINSON BROTHERS, Barnsley, Gas Engineers and Contractors, Makers of Wet and Dry Gas-Meters and General Gas Apparatus, Sulphate of Ammonia Plant, Lead Saturators, Tanks, &c., Tools and Sundries.

WANTED, a young Man, as Gas-Fitter, MAIN and SERVICE LAYER, and METER FIXER, &c. Would have to make himself generally useful.

Address (stating wages required) the MANAGER, Gas-Works, Chepstow, MON.

WANTED, a Working Foreman, to assist the Manager of the Ashbourne Gas-Works. He must be thoroughly competent to take charge of the Works, able to do Main and Service Laying and Fitting. A steady sober man a necessity.

Applicants should send testimonials, and state previous experience and wages required, to E. S. BRADLEY, ASHBOURNE.

FOREMAN WANTED.

REQUIRED, by the Bombay Gas Company, for their Works at Bombay, a GENERAL FOREMAN, possessing a thoroughly practical knowledge of Carbonizing, Retort Setting, and the usual Duties on a Gas-Works. Wages 200 Rupees per month, with House on the Works, Fuel, Gas, and Passage out and home. One who has been accustomed to Foreman's duties preferred.

Engagement for five years.

Applications, by letter only, stating age, qualifications, and if married or single, with *copies only* of testimonials (which will not be returned), to be addressed to the SECRETARY of the Bombay Gas Company, Limited, 6, Drapers Gardens, Throgmorton Avenue, LONDON, E.C. on or before the 14th inst.

IRISH BOG ORE OXIDE OF IRON.

GAS PURIFICATION.

BALE, BAKER, & CO., direct Importers from Ireland. Sample and Price on application. Spent Oxide and Sulphate of Ammonia purchased.

120 and 121, NEWGATE STREET, LONDON, E.C.

TUBES.

FOR Gas, Steam, and Water; Galvanized, White Enamelled, and Hydraulic Tubes, &c.

JOHN SPENCER, Globe Tube Works, WEDNESBURY, and 14, Great St. Thomas Apostle, LONDON.

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, LEEDS, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

COZE'S Automatic Apparatus for CHARGING AND DISCHARGING GAS-RETORTS. For Illustrated Advertisement of this System, see p. 117.

Inquiries should be addressed to THE COZE SYNDICATE, LIMITED, 86-88A, LEADENHALL STREET, E.C.

BENTLEY & CO.

MANCHESTER ELECTRICAL STORES.

FOR Batteries, Bells, Wires, and Special Electrical Apparatus, address the best house 17, NEWTON STREET, PICCADILLY, MANCHESTER.

TAR and Liquor wanted.

BROTHERTON AND CO., Commercial Buildings, LEEDS.

WANTED, a Working Foreman for the Haverhill Gas-Works. Must be a good Carbonizer, Fitter, and Main Layer, also competent to manage Engines and Exhauster. Wages 25s. per week, with good new House, Garden, Coal, and Gas.

Forms of application (to be returned by the 17th of July) may be had of

J. KEMP,
Surveyor to the Local Board.

Haverhill, Suffolk, June 30, 1890.

FOR SALE—One Single Gasholder, 80 feet by 20 feet (owing to extensions at Blackpool). To be erected complete; in first-rate condition.

Apply to CLAYTON, SON, AND CO., LIMITED, Hunslet, LEEDS.

FOR SALE—Second-hand Sulphate of AMMONIA PLANT. Continuous. Open Saturator. Capacity up to 3 tons of Sulphate per 24 hours.

For particulars, &c., address No. 1834 care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—One 8-horse power Engine and COAL BREAKER, with top and bottom Elevator, Gear, and Patent Wrought-Iron Chain, with Malleable Iron Buckets complete.

The above Machinery is almost new, having only been in use about Three months.

For further particulars, apply to the COAL DISTILLATION COMPANY—COOPER'S PATENTS—LIMITED, 323 and 323, Winchester House, Old Broad Street, LONDON E.C.

INSPECTOR OF SUBWAYS AND GAS LIGHTING.

THE Commissioners of Sewers of the City of London are IN WANT of a fit and proper PERSON to fill the above Office, at the Wages of 45s. per week. Age not to exceed 40 years.

A general statement of the Duties can be seen at this Office.

Applications, in Candidate's own handwriting, addressed to the undersigned, with copies of testimonials, must be delivered at this Office on or before Monday, the 14th of July, 1890.

The person elected must give up his whole time to the duties of the Office.

HENRY BLAKE,
Principal Clerk.

Sewers' Office, Guildhall,
July 3, 1890.

THE Hornsey Gas Company have for SALE Two Cast-Iron TOWER SCRUBBERS—one 7 ft. 6 in. diameter by 30 feet high, and the other 10 feet diameter by 40 feet high—in good condition.

Full particulars can be obtained at the GAS-WORKS, Clarendon Road, HORNSEY, N.

IRISH BOG ORE.

A GENTLEMAN in Ireland having a large quantity FOR DISPOSAL would like to hear from large Buyers. Could deliver at Port.

Address No. 1836, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—A 30-Light Croll Meter (Gas-Meter Company). Price 25s.

Apply to Mr. WHEATLEY, 11, Bernard Street, RUSSELL SQUARE, W.C.

JOINTLESS GAS PRESSURE GAUGES. THOMAS'S PATENT.

NOW LARGELY IN USE IN ENGLISH WORKS.

THE Valuable Patent Rights in France, GERMANY, and the UNITED STATES of the above, will be SOLD BY AUCTION, by Mr. CHAS. HY. KNIGHT, at the Mart, Tokenhouse Yard, London, on Thursday, the 24th of July, at One o'clock.

Particulars and Conditions may be obtained of Messrs. E. CARLETON, HOLMES, and SON, Solicitors, 12, Bedford Row, LONDON, W.C.; of H. GARDINER, Esq., Patent Agent, 166, Fleet Street, LONDON, E.C.; of Messrs. RICHARD HOLMES, SON, LEAR, and BELDAM, the Vendor's Solicitors, LITTLEHAMPTON and ARUNDEL; or of the AUCTIONEER, Littlehampton, SUSSEX.

SMALL GASHOLDER FOR SALE.

THE Eton Gas Company have For Sale at their Works at Eton, Bucks, a Second-hand Telescopic GASHOLDER, 80 feet diameter, in two-lifts, 11 feet each deep; six Cast-Iron COLUMNS, 25 feet long; and six Cast-Iron GIRDERS, 17 feet long (no Tank). The whole to be removed within One month after the tender has been accepted, without causing any obstruction to the Works.

Any further particulars required may be obtained of the Manager at the Works, which are 1 mile from the Windsor Station of the G. W. R., and ¾ mile from the S. W. R. Station, also ¾ mile from the River Thames.

Tenders to be sent in addressed to the Chairman, at 134, High Street, Eton, Bucks, on or before Monday, the 28th day of July next, marked "Tender for Gasholder."

The Directors do not bind themselves to accept the highest or any tender.

J. NEEDHAM, Secretary.

High Street, Eton, June 30, 1890.

SOUTH METROPOLITAN GAS COMPANY.

£28,000 of Five per cent. Perpetual Debenture Stock, and £25,000 Ordinary "C" Stock of the above Company, presenting Investments of the soundest description.

MESSRS. G. A. WILKINSON and SON are instructed by the Directors to SELL by AUCTION, at the Mart, on Monday, July 14, at Two o'clock precisely, in numerous Lots, to suit large and small purchasers, £28,000 of FIVE per CENT. PERPETUAL DEBENTURE STOCK, and £25,000 ORDINARY "C" STOCK in the South Metropolitan Gas Company.

The districts supplied by the Company comprise nearly the whole of the South of London from Wandsworth to Plumstead Marshes; and the demand has so much increased that the supply of Gas has been nearly doubled within the last Ten years.

Particulars may be had of FRANK BUSH, Esq., Secretary of the Company, 709A, OLD KENT ROAD; of Messrs. JOHNSON, BUDD, and JOHNSON, Solicitors, 24, AUSTIN FRIARS; and of Messrs. G. A. WILKINSON and SON, Surveyors and Auctioneers, 7, Poultry, CITY.

TO INVESTORS AND CAPITALISTS.

THE KETTERING WATER-WORKS COMPANY.
ISSUE OF NEW ORDINARY SHARES.

MESSRS. ROBINSON and SON are instructed by the Directors to offer for SALE by PUBLIC AUCTION, in Lots, at the Corn Exchange, Kettering, on Friday, July 11, 1890, at Half-past Five for Six o'clock in the evening precisely, pursuant to the Provisions of the Kettering Water-Works Act, 1889 (under which all new Shares are to be offered for Sale by Auction or by Tender before being offered to the existing Shareholders), 1000 NEW ORDINARY SHARES of £10 each in the above Company, part of an additional Capital authorized to be raised for the purposes of the New Works now in course of construction, and which have been rendered necessary by the constantly-increasing demand for the Company's Water, consequent upon the extraordinarily rapid growth of the population and industries of the Town.

For information as to the Company's position, its existing and new Works, and the Dividends lately paid on its present Capital, with printed particulars and conditions of the present issue, apply to the AUCTIONEERS; to Messrs. G. and H. LAMB and STRINGER, Solicitors; or to the SECRETARY of the Company; all of KETTERING.

STOURBRIDGE GAS COMPANY.

DEBENTURE BONDS.

THE above Company are prepared to accept a LOAN of £2500 upon Debenture, at 3½ per cent. per annum for a period of five years, either in One or several sums.

Offers to be sent in to me on or before the 15th inst.

By order,
H. D. HOLLOWAY, Secretary.

Gas Offices, Ambleoote, Stourbridge,
July 1, 1890.

THE Corporation of Ripon invite TENDERS for the supply of New WET and DRY 3, 5, 10, 20, 30, 40, and 50 LIGHT GAS-METERS, from July 21, 1890, to Feb. 28, 1892.

Tenders to be sent on or before Wednesday, the 16th inst., to

J. W. KIRKLEY,
Deputy Town Clerk.

TENDERS FOR COAL.

THE Dukinfield Local Board invite TENDERS for COAL and CANNEL by Wednesday, the 16th inst.

Specification and forms of tender on application to
HARRISON VERVERS, Engineer.

Dukinfield, July 3, 1890.

TENDERS FOR TAR.

THE Dukinfield Local Board invite TENDERS for the TAR produced at the Gas-Works during the ensuing Twelve months, and amounting to about 650 tons.

Tenders by Wednesday, the 16th inst.

HARRISON VERVERS, Engineer.

Dukinfield, July 3, 1890.

LUDLOW UNION GAS COMPANY.

THIS Company are prepared to receive TENDERS for the supply during the Twelve months from June 30, 1890, to June 30, 1891, of from 1200 to 1500 tons of best screened GAS COAL, in quantities to suit the requirements of the Company.

Tenders to be forwarded to J. W. MONTFORD, Solicitor, Ludlow, SALOP.

BOROUGH OF EVESHAM.

THE Gas Committee are prepared to receive TENDERS for the surplus TAR and LIQUOR produced at the Evesham Gas-Works for Twelve months from the 1st of August, 1890, delivered into Contractors' Barges on the River Avon (which runs alongside) by a pipe direct from the Works.

Coal carbonized, about 1500 tons per annum.

Sealed tenders to be sent in to me on or before Monday, the 14th of July, 1890.

By order,
THOS. COX, Town Clerk.

Evesham, June 24, 1890.

BOROUGH OF MACCLESFIELD.

THE Gas Committee are prepared to re- ceive TENDERS for the supply of the whole, or part, of 6000 tons of the best screened GAS COALS and 1000 tons of CANNEL, delivered free at Macclesfield, to commence on the 1st day of September, 1890, extending One year, and in such quantities as may be ordered.

Tenders, sealed and endorsed, to be sent in not later than the 19th day of July, 1890, addressed to the Chairman, Gas Committee, Town Hall, Macclesfield.

The Committee do not pledge themselves to accept the lowest or any tender.

(Signed) W. FREDK. TAYLOR,
Town Clerk.

July 2, 1890.

TO ENGINEERS AND IRONFOUNDERS.

TENDERS are invited for Retort-House ROOF and MOUNTINGS of Retort-Bench.

Bill of Quantities may be had on deposit of Two guineas, which will be returned for a *bonâ fide* tender.

Specification and drawings may be seen at the Gas Offices, and at the Office of Mr. T. Newbigging, C.E., 5, Norfolk Street, Manchester.

Tenders, endorsed "Ironwork of Retort-House," to reach me by noon on Friday, the 18th inst.

The lowest or any tender not necessarily accepted.

By order of the Directors,
ROBERT HALL,
Secretary and Manager.

Offices: Crown Buildings, Matlock,
July 5, 1890.

ASHFORD, KENT.

TENDERS FOR COAL.

THE Directors of the Ashford Gas and Coke Company, Limited, are prepared to receive TENDERS for the supply of about 3000 tons of Screened or Unscreened GAS COALS, to be delivered on the Siding at their Works, at Ashford, in equal monthly quantities, from the 1st of September next to the 31st of March, 1891.

Tenders, specifying the description of the Coals, the Pits at which they are raised, and the terms for net monthly payment, to be sent to me on or before the 25th day of July inst., endorsed "Tender for Coals."

F. HUGHES-HALLETT,
Secretary.

Ashford, July 2, 1890.

HEREFORD CORPORATION.

TO TAR DISTILLERS AND OTHERS.

THE Gas Committee invite Tenders for the Surplus TAR produced at their Works for a term of One, Two, or Three years from July 1, 1890.

Particulars and form of tender may be had on application to the undersigned.

Sealed tenders, addressed to the Chairman of the Gas Committee, Mansion House, Hereford, and endorsed "Tender for Tar," must be sent in not later than July 12, 1890.

The Committee do not bind themselves to accept the highest or any tender.

By order,
WILLIAM PARLBY, Gas Engineer.

Gas-Works, Hereford,
June 24, 1890.

HOLMSIDE GAS COALS.

THE Owners of Holmside and South Moor Collieries possess an undivided area of nearly 5000 acres of COAL in the County of Durham, over the greater portion of which area the most of the best Coal of the district, including the well-known Hutton Seam, remains almost untouched; and as preparations are being made for working the Hutton Seam on a large scale, it is expected that the reputation of HOLMSIDE GAS COALS will be still further increased. The Holmside and South Moor Collieries have been in the hands of the same families for over half a century; but, until lately, no adequate attempt has been made to open out their very large Coal-Field, notwithstanding that the best Coal of the district around them, and especially the Hutton Seam, has been for some time past seriously diminished by reason of the vigorous workings of neighbouring coal-owners. Holmside Gas Coals are now being worked out of Holmside and South Moor Collieries at a rate of about 2200 tons per working day—a rate totally inadequate to meet the existing demand. By an extensive development of workings in the Hutton Seam, it is hoped that the demand may be fully met, and the quality raised to the highest point attainable by Durham Coal.

For price and particulars, apply to MARK ARCHER, Holmside and South Moor Offices, Quayside, NEWCASTLE-ON-TYNE.

TENDERS FOR GAS COAL.

THE Lighting Committee of the St. Mary Church Local Board invite TENDERS for 1200 tons of approved GAS COAL, to be weighed over their Weigh-bridge, and delivered free into the Stores at the Works, in the following quantities—viz., 200 tons in July, do. in September, November, December, 1890, and January and March, 1891; or in such quantities and at such times as the Manager may direct.

Sealed tenders to be sent to the Chairman of the Lighting Committee, Gas Office, Barton Road, St. Mary Church, Torquay, not later than the 17th inst.

The lowest or any tender will not necessarily be accepted.

Further particulars from T. EVANS, Manager.

Gas-Works, St. Mary Church,
Torquay, July 5, 1890.

CARDIFF GASLIGHT AND COKE COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company are prepared to receive TENDERS for a supply of 50,000 tons of best, well screened, large GAS COALS, to be delivered between July, 1890, and June 30, 1891, in monthly quantities in accordance with the Specification.

Parties tendering may do so for the whole quantity, or for quantities from 5000 tons upwards.

Forms of tender and specification of monthly deliveries may be obtained on application to Mr. H. Morley, the Company's Engineer.

Sealed tenders to be sent to the undersigned not later than Thursday, the 17th day of July next, addressed to the Chairman of the Company, and endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender, and reserve to themselves the right to apportion the whole quantity as they may think fit.

By order,
GEORGE CLARRY, Secretary

Gas Office, Cardiff, June 20, 1890.

BOROUGH OF PORTSMOUTH WATER-WORKS COMPANY.

TENDERS FOR COAL.

THE Directors of this Company are prepared to receive TENDERS for a supply of about 1600 tons of any of the following BEST WELSH SMOKELESS LARGE STEAM COAL; the coal to be delivered in trucks at Havant Railway Station, or to be delivered at the Company's Upper Redhampton Mill Siding, Redhampton, near Havant, at the rate of about 30 tons weekly, or in such other quantities as the Directors may require, the quantity to be delivered to be regulated from time to time as the Company's Resident Engineer may direct—

Nixon's Merthyr.	Wayne's Merthyr.
Cwmaman.	Powell's Duffryn.
Ferndale.	Navigation Steam.

The coal to be clean, dry, and fresh worked; and the Tenders are to specify the description of coal, the name of the pit, and the particular seam from which the coal is to be supplied.

Tenders to be addressed to the Secretary, endorsed "Tender for Coal," are to be delivered at the Company's Offices, Commercial Road, Portsmouth, on or before noon, on Thursday, the 17th of July inst. Price to be quoted per ton for delivery at Havant Railway Station, and also per ton for delivery at the Company's Upper Redhampton Mill Siding above mentioned.

Payments, cash monthly, subject to 2½ per cent. off.

The Directors do not bind themselves to accept the lowest or any tender.

Tenders to be on forms which, with all other information, can be had of the Resident Engineer at the Company's Offices.

The Directors reserve the right of testing samples of the coals tendered for and supplied; and deductions will be claimed in respect of inferior quality or short weight.

By order,
R. W. FORD, Secretary.

Portsmouth, July 3, 1890.

The Subscription List will Open this day (Tuesday), the 8th inst., and Close at or before Four p.m. on Thursday, the 10th inst., for both Town and Country.

Saving of 70 per cent. in the Carbonizing of Coal. An average saving of 2s. 3d. per ton on all Coal Carbonized. A saving of One Million Sterling per annum to Gas Companies in the United Kingdom alone.

This Company's Patent Apparatus is being erected by some of the principal Gas-Works in the United Kingdom. The Gaslight & Coke Company, the South Metropolitan Gas Company, the Brentford Gas Company, and a number of other Companies and Corporations are now fitting up Plant under this System.

THE AUTOMATIC COAL-GAS RETORT COMPANY,

(Incorporated under the Companies' Acts, 1862 to 1887.) [LTD.

Capital £250,000, in 250,000 Shares of £1 each,

Payable 2s. 6d. on Application; 7s. 6d. on Allotment; and the Balance One Month after Allotment.

Directors:

WALTER KING, Esq., JOURNAL OF GAS LIGHTING, Temple Chambers, and 11, Bolt Court, Fleet Street, London, E.C.
THOMAS CHAS. HERSEY, Esq., Civil Engineer, Director of the Anglo-Portuguese Gas Company, Limited, and Messrs. Kirkham, Hulett, and Chandler, Limited, Gas Apparatus Manufacturers, London.
JAMES M. KELLY, Esq. (of Messrs. James Kelly and Son, Coal Factors, 10, South Castle Street, Liverpool).
EDWIN MUIR, Esq., M. Inst. C.E., M. Inst. M.E., F.G.S., &c., Consulting Engineer, 37, Cross Street, Manchester.
J. H. SHELDRAKE, Esq., Managing-Director of D. Hulett and Co., Limited, Gas Lighting Engineers, 55 and 56, High Holborn, London, W.C.
Major-General CHENEVIX TRENCH, C. M. G., 26, Onslow Gardens, London, S.W.

Consulting Engineer:

F. MORRIS, Esq., M. Inst. C.E., Engineer and Manager to the Brentford Gas Company.

Engineer:

L. VAN VESTRAUT, Esq., Gas Engineer, Southall (who is resigning his position as Assistant-Engineer to the Brentford Gas-Works, Southall, to take this appointment).

Bankers:

THE LONDON JOINT STOCK BANK, Limited, 5, Princes Street, London, E.C., and Branches.
THE MANCHESTER AND LIVERPOOL DISTRICT BANKING COMPANY, Limited, 75, Cornhill, London, E.C., Manchester, Liverpool, and Branches.

Solicitors:

Messrs. PARKER, GARRETT, and PARKER, the Rectory House, St. Michael's Alley, E.C.

Brokers:

London—Messrs. F. A. HELPS and SON, 9, Cornhill, and Stock Exchange, London, E.C.; PETER HURST, Esq., 4, Drapers' Gardens, and Stock Exchange, London, E.C.
Liverpool—Messrs. HENRY E. RENSBURG and CO., 10, Dale Street, and Stock Exchange, Liverpool.
Leeds—Messrs. JOHN REDMAYNE and CO., 79, Albion Street, and Stock Exchange, Leeds.
Manchester—Messrs. FERNYHOUGH and ASHE, 14, Cross Street, and Stock Exchange, Manchester.
Sheffield—Messrs. BARBER BROS. and WORTLEY, Stock Brokers, Sheffield.
Bristol—Messrs. BETTON, SAYCE, VAUGHAN, and CO., 2, Clare Street, Bristol, and at Newport.
Dublin—Messrs. MOLONY and MURRAY, 52, Dame Street, and Stock Exchange, Dublin.

Secretary (Pro tem.)
Mr. W. M. KIGHT.

Offices:
86 AND 88A, LEADENHALL STREET, LONDON, E.C.

ABRIDGED PROSPECTUS.

The Company is for the purpose of acquiring—

1st. The monopoly and rights for the United Kingdom in respect of certain inventions for improvements in apparatus for charging and discharging Gas-Retorts on the system devised and patented by M. Coze, with improvements by Messrs. Morris and Van Vestraut.

2nd. The monopoly and rights for the countries hereinafter specified of the above-mentioned improvements by Messrs. Morris and Vestraut.

The patents (Nos. 7563, of 1885; 16,486, of 1889; and 16,489, of 1889) constitute a system which has been thoroughly tested with most satisfactory results, and plant upon the said system is now being erected by the leading Gas Companies in the United Kingdom.

The necessity of the employment of skilled labour is dispensed with, and that without the aid of expensive machinery.

The fact that Gas Companies are at all times peculiarly open to strikes of their workmen (as has been so vividly illustrated, not only in England, but also on the Continent, quite recently) adds vastly to the importance of these patents, inasmuch as work hitherto accomplished by hand is, under them, practically accomplished by an automatic system, without the aid of skilled labour.

The following is an extract from the speech of Colonel Makins, M.P., as the Governor of The Gaslight and Coke Company, at a meeting held on the 7th of February, 1890:—

"An enormous saving in the cost of labour will be effected by the inclined retorts which we hope to have substituted for the 'horizontal ones.' It is proposed to fit up the new house at Kensal Green with these sloping retorts, to which the stokers has facetiously given the name of 'Ally Slopers.'"

The proposal here referred to is now being carried out.

The following is the opinion of an Engineer to one of the principal Metropolitan Gas Companies, as to the saving effected by adopting this process: Taking cost of the setting and construction only, and considering the advantages in the reduction of stage labour, the profit of this system to the Gas Company will be from 1s. 6d. to 3s. per retort per day, according to the plan adopted, or say an average of 2s. 3d. per ton. This for 200 working days gives, at 2s. 3d., £22 10s. profit per retort per annum. The cost of the royalty would thus be saved in about the first two months, to say nothing of the reduction in the cost of staging, as also in skilled labour, &c.

Mr. John Aird, M.P. (of Messrs. John Aird and Son, the well-known contractors), reported at the meeting of the Cagliari Gas Company that their Engineer, by instruction of the Board, had called at Rheims to inspect M. Coze's system of inclined retorts, and they had M. Simmelkjœr's report before them. His conclusions were: "(1) The beauty of the invention is its simplicity. M. Coze has, with the simplest means, obtained very important advantages. (2) Considerable saving of labour; no skilled labour required; any man with strength to move a wheelbarrow can work the system. (3) Coal is distributed more evenly and much quicker than the best stoker could do it on the old system; consequently a greater yield of gas, less fuel used, and less wear and tear of plant.' No doubt a sound practical opinion from their very able Engineer would interest a great many." Colonel Makins, M.P., has also a good word to say of the Coze system. In referring to increases in the labour department, he remarked that they were slowly gravitating to a wider application of labour-saving machines. In fact, continued the gallant Colonel, "the scarcity of labour in this country, whether artificially produced or otherwise, will put us in the same position as the Americans, who, for some time past, have been harassing their brains in order to invent and perfect all sorts of machines to save the cost of production, and we shall be obliged to look everywhere we can for appliances to reduce the cost of making our gas." The inclined retorts are not, be it remembered, mere matters of experiment."—*Vide Gas Engineer's Magazine.* March 1, 1890.

Morris and Van Vestraut's Patent (English No. 16,489, of 1889) for the following countries have already been granted:—England, Germany, United States of America, Switzerland, Italy, Portugal, Spain, Denmark.

The Company also acquire the rights for the following countries; and patents or other protection in these countries are in course of being applied for: France, Russia, Turkey, India, Sweden, Japan, Austria, Norway, Greece, West Indies, Uruguay, Chili, Natal, Roumania, China, Persia, Peru, Mexico, British Guiana, Ecuador, Egypt, Tasmania, New Zealand, Cape Colony, Brazil, Argentine Republic, Ceylon, Gibraltar, Corfu, Algeria, Corsica, Mauritius, Malta.

The patent of Messrs. Morris and Van Vestraut has been taken out and reported upon by Messrs. Abel and Imray, the well-known Consulting Engineers and Patent Agents; and Mr. Ashton, Q.C., and Mr. W. Roger Wallace have advised as to the validity of the patent.

The process has been examined and reported upon by the following well-known Gas Experts: Thomas Newbigging, Esq., M.Inst.C.E., Manchester; A. F. Phillips, Esq., C.E., Westminster; and Henry Woodall, Esq., C.E., Llandudno. (See reports enclosed with the Prospectus.)

Estimate of gross receipts from the United Kingdom alone shows that, at the expiration of the sixth year from the commencement, the Company will have received £451,250, or nearly double the amount of the Capital of the Company, after which there will remain a royalty of 6d. per foot per retort—equivalent to an annual income of £25,000—and this without taking into consideration the manufacturers' profit, accruing in the case of many of the Gas Companies, who will, it is anticipated, require this Company's Contractors to erect their plant under Contract.

The above is without taking into consideration the profits to be earned from sales outright, and by granting Royalties in foreign countries, which, owing to the enormous amount of coal carbonized for gas making, must, in addition, yield large returns. Considering the great saving effected by Gas Companies, and the success the invention has met with, there is little doubt as to its universal adoption.

Negotiations are pending for the sale of the Morris and Van Vestraut's patent and patent rights in America and certain other important countries.

The following Contract for acquiring the said Patents and rights for £200,000, payable as to £60,000 in fully paid-up Shares in the Company and as to the residue in cash has been entered into: Contract dated the 10th day of June, 1890, and made between the Retort Syndicate, Limited, and the Coze Syndicate, Limited, of the one part, and Walter Matthew Kight, as trustee for and on behalf of this Company, of the other part.

All expenses up to allotment will be paid by the Vendors.

Prospectuses and Forms of Application for Shares may be had of the Bankers, Brokers, Solicitors, and at the Office of the Company.

Dated *June* 12, 1890.

REPORTS OF EXPERTS ON THE AUTOMATIC COAL-GAS RETORTS.

Report by A. F. Phillips, Esq., C.E., the well-known Consulting Gas Engineer.

31, *Great George Street, Westminster, S.W., June* 10, 1890.

Having examined and considered the methods of charging and discharging gas-retorts by gravitation on the system of M. Coze, with the improvements by Messrs. Morris and Van Vestraut, I am of opinion the following advantages are obtained thereby:—

1. Economy and control of labour.
2. Saving in retort-house room and staging.
3. Economy of time; quicker stoking.
4. Increased durability of retorts.
5. Economy of ironwork, only one hydraulic main and set of ascension pipes being required.
6. Greater production of gas per retort.
7. Convenience for scurfing.

I can recommend its adoption by any Gas Company desirous of extending its productive power.—I am, yours faithfully,

A. F. PHILLIPS.

Report by the well-known Consulting Gas Engineer, Thomas Newbigging, Esq., C.E.

5, *Norfolk Street, Manchester, June* 19, 1890.

I have seen these methods in operation, and can thoroughly endorse the annexed report of Mr. A. F. Phillips.

THOMAS NEWBIGGING.

Report by the well-known Consulting Gas Engineer, Henry Woodall, Esq., C.E.:

Llandudno, June 18, 1890.

I have thoroughly examined the Coze System of "Automatic Coal-Gas Retorts" in operation at Rheims, where they have been in full and constant work for two years, and most thoroughly endorse the report of Mr. A. F. Phillips, C.E., dated the 10th inst.—Yours faithfully,

HENRY WOODALL.

TENDERS FOR SCREENED GAS COAL AND SCREENED GAS NUTS.

THE Market Rasen New Lighting Company, Limited, are open to receive TENDERS for the supply of 600 tons of Screened GAS COAL, and 200 tons of Screened GAS NUTS, to be delivered at the Market Rasen Railway Station.

For any further particulars, apply to the Manager, at the Gas-Works.

JOSEPH HARPER, Manager.

DENTON AND HAUGHTON LOCAL BOARD.
(GAS DEPARTMENT.)

OXIDE.

TENDERS are required on or before the 19th of July, 1890, for the supply of 50 tons of OXIDE OF IRON.

OFFERS will also be received for about 80 tons of SPENT OXIDE.

Particulars may be obtained from Mr. J. M. Veevers, Gas-Works, Denton, near Manchester.

By order,
JOHN RICHARDS,
Clerk to the Board.

MILFORD IMPROVEMENT ACT, 1857.

SUPPLY OF GAS COAL.

TENDERS are invited for the supply of GAS COAL for One year from the 29th of September, 1890—any quantity as required up to 800 tons.

Tenders, on the prescribed form, addressed to the Chairman of the Commissioners, and endorsed "Gas Coal," must be sent in on or before Friday, the 18th inst.

The lowest or any tender not necessarily accepted.

Particulars and form of tender on application to the undersigned.

PEREGRINE THOMAS,
Clerk to the Milford Improvement Commissioners.

Commissioners' Offices,
Milford Haven, July 2, 1890.

TIPTON GAS-WORKS.

BRICK GASHOLDER TANK.

THE Gas Committee of the Tipton Local Board are prepared to receive TENDERS, for the construction of a BRICK GASHOLDER TANK 102 feet diameter and 25 feet deep.

Drawings and specification may be seen and other particulars obtained at the Gas-Works, on application to Mr. Vincent Hughes, the Engineer.

Sealed and endorsed tenders to be sent to me, th undersigned, on or before Tuesday, the 22nd day o July, 1890.

The Committee do not bind themselves to accept the lowest or any tender.

By order,
G. M. WARING, Clerk to the Board.

Tipton, July 5, 1890.

BOROUGH OF ILKESTON.

THE Gas Committee are prepared to receive TENDERS for the supply and delivery at their Gas-Works of 5000 tons of GAS COAL.

Conditions and form of tender may be had of the Manager (Mr. F. C. Humphrys), at the Gas-Works, Rutland Street, Ilkeston.

Sealed, endorsed tenders must be delivered to the undersigned by Four o'clock in the Afternoon of Thursday, the 24th day of July next.

The Committee do not bind themselves to accept the lowest or any tender; and they reserve to themselves the right to divide the quantity above named into two or more contracts.

By order,
WRIGHT LISSETT,
Town Clerk.

Town Hall, Ilkeston, June 30, 1890.

BOROUGH OF ROCHDALE.

TO CHEMICAL MANUFACTURERS.

THE Gas Committee of the Corporation invite TENDERS for the supply of such quantities of BROWN OIL OF VITRIOL as they may require during the ensuing Twelve months. The acid to be made from Pyrites or recovered Sulphur, and to be delivered at the Rochdale Railway Station.

Further information can be obtained from Mr. T. B. Ball, Manager, Gas-Works, Rochdale.

Tenders, endorsed "Vitriol," must be sent to me not later than Noon of Wednesday, the 16th of July inst.

By order,
ZACH. MELLOR, Town Clerk.

Town Hall, Rochdale,
July 4, 1890.

NEWPORT (SALOP) GASLIGHT AND COKE COMPANY, LIMITED.

TENDERS FOR COAL.

THE Directors of the above Company invite TENDERS for the Supply of a high-class GAS COAL delivered Free at Newport (Salop) Railway Station for Twelve months, from the 9th of August, 1890, at per ton.

The estimated quantity of coal required for the Twelve months is about 650 tons.

The coal to be delivered as required by the Company.

Payments, monthly.

Tenders to be addressed and sent to me on or before the 13th day of July, 1890.

The Directors do not bind themselves to accept the lowest or any tender.

Further particulars may be obtained from me or at the Gas-Works, Newport, Salop.

R. N. HEANE, Secretary.

COUNTY BOROUGH OF STOCKPORT.
(GAS DEPARTMENT.)

TO IRONFOUNDERS.

THE Gas Committee are prepared to receive TENDERS for 400 3-inch plain Socket and Spigot PIPES, 9 feet long, exclusive of Socket; weight not to exceed 3 qrs. 14 lbs. Also for 200 4-inch ditto; weight not to exceed 1 cwt. 1 qr. 14 lbs. Also price per hundredweight for IRREGULARS.

Tenders, stating price per ton delivered free at Stockport Station, to be sent in, under seal cover, endorsed "Tender for Pipes," and addressed to the Chairman of the Gas Committee, on or before Thursday, July 10, 1890.

The Committee do not bind themselves to accept the lowest or any tender.

Further particulars may be obtained on application to the undersigned.

JAMES JACQUES,
Engineer and Manager.

Gas-Works, Stockport,
June 30, 1890.

TENDERS FOR TAR AND LIQUOR.

THE Directors of the Slough Gas and Coke Company are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR (or either) produced at their Works, for a term of One year, from the 30th of June, 1890.

The Slough Branch of the Grand Junction Canal is available.

The estimated quantities to be produced are: Tar, 20,000 gallons; and Liquor, 45,000 gallons.

Further particulars may be obtained on application to the undersigned.

Sealed tenders, stating price for tar per barrel of 36 gallons, and prices for ammoniacal liquor per 1000 gallons of different strengths, at the Company's Works, and endorsed "Tender for Tar and Liquor," to be delivered on or before Tuesday, the 22nd of July next.

The Directors do not bind themselves to accept the highest or any tender.

ARTHUR THOMAS, Secretary.

High Street, Slough, June 25, 1890.

TAR.

THE Directors of the Cheltenham Gas-light and Coke Company invite TENDERS for the purchase of the surplus TAR made at their Works for One, Two, or Three years, commencing on the 1st day of October, 1890.

Particulars may be obtained from the undersigned, to whom tenders must be sent on or before the 17th day of July next.

The Directors do not bind themselves to accept the highest or any tender.

R. O. PATERSON, Engineer.

Gas-Works, Cheltenham,
June 21, 1890.

TO COAL FACTORS AND OTHERS.

THE Directors of the Tunbridge Wells Gas Company will be prepared, on Thursday, the 17th of July, 1890, to receive TENDERS for the supply of from 8000 to 10,000 tons of either NEW PELTON, NEW TANFIELD, EAST PONTOP, BRANCEPETH, or other approved GAS COALS at the option of the Directors; and from 3000 to 5000 tons of best SOUTH YORKSHIRE SILKSTONE COAL or NUTS from the same, to be delivered into their Siding on the South-Eastern Railway at Tunbridge Wells in such monthly quantities, from August, 1890, to April, 1891, as may be directed, in accordance with terms and conditions which may be obtained on application.

The tenders are to be sent to me by not later than Four o'clock p.m. on Thursday, the 17th of July, marked "Tender for Coals."

The lowest or any tender will not necessarily be accepted.

By order,
JOHN READ, Secretary.

Gas Company's Office, Tunbridge Wells,
June 30, 1890.

HEALTH Exhibition, Royal Pavilion, BRIGHTON, including Sanitary Apparatus and Appliances, Arrangements for Water Supply, Heating and Cooking Apparatus, Electric Lighting, Smoke-Preventing Appliances, Articles relating to Personal Hygiene, Domestic Economy, Foods, Clothing, Life and Labour Saving Appliances, &c., to be held from Aug. 25 to Sept. 18, 1890, in connection with the AUTUMN CONGRESS OF THE SANITARY INSTITUTE.

Prize Medals and Certificates of Merit will be awarded for Approved Exhibits.

Forms of application for space and all particulars can be obtained from the CURATOR (Mr. W. H. Knight), 74A, Margaret Street, LONDON, W.

Price 6s., Cloth Bound, Bevelled Boards,

THE

GUIDE-FRAMING OF GASHOLDERS

AND OTHER PAPERS

CHIEFLY RELATING TO

STRAINS IN STRUCTURES CONNECTED WITH GAS-WORKS.

BY

F. SOUTHWELL CRIPPS, Assoc. M. Inst. C.E.

Reprinted from the JOURNAL OF GAS LIGHTING, *Fully Revised and Corrected by the Author, with many Additions.*

LONDON:
WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

C. & W. WALKER.

GASHOLDERS; PURIFIERS; PURIFYING MACHINES;

CO_2 AND TAR-EXTRACTING WASHERS; SCRUBBERS;

SULPHATE & SULPHUR PLANT;

RETORT MOUTHPIECES; CONDENSERS;

LIFTING APPARATUS; CENTRE AND FOUR-WAY VALVES;

SLIDE VALVES; TAR BURNERS; &C. &C.

WOOD SIEVES.

ADDRESSES: 8, Finsbury Circus, London, E.C.; Midland Iron-Works, Donnington, near Newport, Shropshire.

"FORTRESS LONDON." "FORTRESS DONNINGTON,"—Telegraphic.

Price 2s. per dozen, or 10s 6d. per 100, post free.

CONSPIRACY and Protection of Property Act. It is required, under a Penalty of FIVE POUNDS, that a Printed Copy of the 4th Section of this Act shall be posted up at all Gas-Works, in a conspicuous place, where the same may be conveniently read by the persons employed thereat.

Printed copies of this Section, in large type, on broad sheets, may be obtained of WALTER KING, 11, Bolt Court, FLEET STREET, E.C.

*** *The Act extends to Scotland and Ireland.*

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on application.

G. E. TOURNAY,
Contractor for the Erection and Re-Building of
GAS-RETORT SETTINGS,
CHIMNEY SHAFTS,
FURNACES, & BOILER SETTINGS,
THANNINGTON, CANTERBURY.

THOS. W. WARD,
COKE & IRON MERCHANT,
Fitzalan Chambers, SHEFFIELD,
BUYER of OLD GASOMETERS,
Every description of Scrap Iron and Steel, Works for Dismantling, Disused Engines, Boilers, &c., in any part of the Country for Cash.

PATENTS FOR INVENTIONS,
REGISTRATION OF TRADE MARKS and DESIGNS in all Countries.
SEARCHES made *re* novelty, and opinions given on all matters connected with above. *Full particulars on application to*
J. C. CHAPMAN,
Assoc.M.Inst.C.E., M.Inst.M.E., Fel. Inst. Patent Agents,
70, CHANCERY LANE, LONDON, W.C.

Special experience in Gas and Ammonia Plant.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
MIRFIELD, NORMANTON.

NEWBATTLE CANNEL.
QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

THOMAS ILLINGWORTH,
NORTH DEAN CHEMICAL WORKS,
Near HALIFAX,
MANUFACTURER OF SULPHURIC ACID
OF EXTRA QUALITY FOR MAKING
WHITE SULPHATE OF AMMONIA.
TAR, LIQUOR, AND SPENT OXIDE Purchased for Cash against Delivery.

For FIRE-BRICKS, the most durable for GAS-FURNACES,
ADDRESS
JAMES WHITE & Co.,
ALBERT WORKS, WIDNES.

COKE BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT.)
New Design, with two Cutting Rollers, making less Breeze than their old pattern.
GEORGE WALLER & CO.,
PARK STREET, SOUTHWARK, E.C.

ROBERT HOLSWORTH,
103, BOSTON STREET,
HACKNEY ROAD, LONDON, N.E.
Telegraphic Address: "HOLSWORTH LONDON,"
MANUFACTURER OF
FLAT and ROUND HEMP and MANILLA ROPES, LINES, SCAFFOLD CORDS, SPUN YARNS, GASKETS, and TWINES of every description; COAL, COKE, and CORN SACKS, TARPAULINS and WATERPROOF COVERS, MATS, and MATTING.
CONTRACTS TAKEN.
ESTABLISHED, 1831.

THOMAS TURTON AND SONS, LIMITED,
Sheaf & Spring Works,
SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
London Office:
90, CANNON STREET, E.C.
PARIS DEPÔT: 8, BOULEVARD DE BELLEVILLE.

THE SILICA FIRE-BRICK COMPANY,
OUGHTIBRIDGE, near SHEFFIELD,
MANUFACTURE
SILICA BLOCKS, BRICKS, AND CEMENT
OF SUPERIOR QUALITY
FOR GAS-FURNACES.
Trade Mark: "SILICA."
These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
GREATER DURABILITY,
Strongly recommended where EXCESSIVE HEATS have to be maintained.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.
Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

JAMES OAKES & Co.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road,
CITY ROAD, LONDON, N.
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1¼ to 48 inches in diameter; and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE. — Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts, and covers, and rendering leakage impossible.

GAS AND WATER PIPES.
1¼ to 12 IN. BORE.

THOMAS ALLAN & SONS,
Bon Lea Foundry,
SOUTH STOCKTON-ON-TEES.
ALSO MANUFACTURERS OF
SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.
GLASGOW OFFICE: 24, GEORGE SQUARE.
Telegrams:
"BONLEA, STOCKTON-ON-TEES."
"SPRINGBANK, GLASGOW."

Lanemark Coal Co.,
LIMITED.
LANEMARK CANNEL
AND GAS COALS.
Quotations and Analysis on application to
LANEMARK COLLIERY,
NEW CUMNOCK, N.B.
Shipping Ports: All the principal Scotch Ports.

GAS COAL.
BEST
REAL OLD SILKSTONE GAS COAL.
Address, THE STRAFFORD COLLIERIES COMPANY,
Near BARNSLEY, SOUTH YORKSHIRE.

THE BEST AND SIMPLEST SYSTEM OF

VALVES FOR PURIFIERS

Is Weck's Patent arrangement of Three-Way Disc Valves, either separate for Purifiers fixed in line, or arranged together as a

CENTRE-VALVE

When the Purifiers are fixed in square.

No Leakage. No Foul Gas passed in changing. All the Purifiers in action, or any less number. Clean Box emptied of Air before taking into use.

DESCRIPTIVE PAMPHLET ON APPLICATION.

F. WECK,

JOHN BRIGHT ST., BIRMINGHAM.

CAST-IRON PIPES

FOR GAS AND WATER.

VALVES

FOR GAS, WATER, AND STEAM.

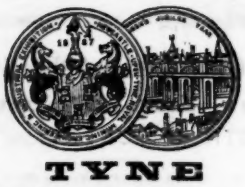
TELEGRAMS: "PIPES GLASGOW."

WM. MACLEOD & CO.,

56, ROBERTSON STREET, GLASGOW.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.



TYNE BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

For Prices and complete Analysis, apply to

YOUNG, DANCE, & CO.,

COAL OWNERS, NEWCASTLE-ON-TYNE,

Or E. FOSTER & CO. 21, John St., Adelphi, LONDON, W.C.

The GRANTHAM CRANK & IRON Co., Ld.,

Manufacturers of

VERTICAL, — PORTABLE, — CORNISH AND LANCASHIRE

BOILERS.

Send for List 166.

Liberal Terms TO Shippers and the Trade.

GRANTHAM.

THE Étoile Gas Lamp PATENT

THE ÉTOILE GAS-LAMP COMPANY,

Gas Lighting and Ventilating Engineers, Brass and Iron Founders, and General Metal Spinners.

124 and 126, PRINCESS STREET, MANCHESTER.

PRICE LIST ON APPLICATION.

Is now Ready, the Fifth Edition of the

HANDBOOK

FOR

Gas Engineers and Managers.

BY

THOMAS NEWBIGGING,

Member of the Institution of Civil Engineers.

PRICE: MOROCCO, GILT, 18s.; CLOTH, 15s.; DELIVERED FREE.

LONDON:

WALTER KING, "JOURNAL OF GAS LIGHTING," ETC., 11, BOLT COURT, FLEET STREET, E.C.

WATER GAS FUEL GAS

FOR INDUSTRIAL PURPOSES,

GENERATED FROM

BITUMINOUS SLACK COAL

BY THE

LOOMIS PROCESS.

The most Economical Gas-Generating System in the World.

Process and Apparatus patented in all Countries.

Many industrial Works in America are successfully using this Process in the manufacture of Steel, Pipes, Saws, Files, Cutlery, Watches, Pottery, Tiles, &c.

A Plant has been put into operation at the Works of Messrs. Thos. Firth and Sons, Limited, Sheffield; and they have decided to enlarge it. Other Plants are being erected in Great Britain and on the Continent.

For particulars apply to

NEWTON, CHAMBERS, & Co., Limited,
THORNCLIFFE IRON-WORKS,
Near SHEFFIELD.

SPENT LIMES NO LONGER WASTE PRODUCTS.

Under G. R. HISLOP'S PATENTS

All Spent Limes are most effectually, economically, and continuously recovered, and at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it. Descriptive Pamphlet and Terms from Agents as under.

— REGENERATIVE SETTINGS OF RETORTS. —

Hislop's Patent Producer and Patent Charging Appliances offer advantages which are unapproachable, while in every other detail his Settings are confidently recommended as being the most inexpensive and effective possible.

Illustrated Pamphlet and Terms on application to J. E. FISHER, Stourbridge, Agent for England and Wales; to C. M. HAMILTON, Portland Place, Hamilton, Agent for Scotland and Ireland; and for all other Countries to the Patentee,

Geo. R. HISLOP, Gas Engineer, PAISLEY, N.B.

ROOTS' PATENT "ACME"

GAS EXHAUSTERS.

POSITIVE IN ACTION. SIMPLE IN CONSTRUCTION. DURABLE & SOLID IN DESIGN.

All Working Parts external and unaffected by Gas.

SOLE LICENSEES under Roots' Latest Patents,

SAMUELSON & CO., LTD., BANBURY, OXON.

SIXTY PER CENT. ECONOMY IN GAS LIGHTING.

The Schülke Regenerative Lamp

FOR

DOMESTIC AND EXTERNAL LIGHTING.

The only Regenerative Lamp employing the Common Flat-Flame Burners.

Lamps giving 20-Candle power consume less than four feet of Gas per hour.

PURE WHITE & PERFECTLY STEADY LIGHT,

NOT AFFECTED BY DRAUGHTS.

Suitable for any existing fittings (Brackets or Suspending).

Can be fixed in a few minutes.

May be seen at the Offices of the

SCHÜLKE GAS-LAMP Co.

LIMITED,

Room 446—11, QUEEN VICTORIA STREET, LONDON, E.C.,

Where Price Lists and full particulars may be obtained.

RED OXIDE OF IRON PAINT.

THE BEST KNOWN PRESERVATIVE FOR IRONWORK.

Sold in large quantities on better terms than can be obtained from any other manufacturer.

Also sold in powder in 1 cwt. kegs, at 7/6 per cwt.

In oil as a paste ready for mixing, at 25/- per cwt.

As a paint ready mixed for use, at 3/9 per gallon, in 5-gallon cans, or in packages to suit buyers.

INQUIRIES SOLICITED.

Boiler Incrustation Prevented

BY USING

Used at the following Gas-Works:—Ascot, Birmingham, Broadstairs, Bromsgrove, Hendon, Leven, N.B., Pembroke, Seaham Harbour, Stamford, Warwick, &c., &c.; and by leading Engineers throughout the country.

Absolutely harmless, and the most economical means of preventing Incrustation obtainable.

TESTIMONIALS ON APPLICATION.

ADOLPHE CROSBIE, Walsall Street Chemical Works, WOLVERHAMPTON

RETORT SETTINGS IMPROVED

BY ADOPTING

THE "NUGENT" & "ROBUS" SETTINGS.

ECONOMY WITH DURABILITY GUARANTEED.

HUNDREDS OF SETTINGS WORKING EMINENTLY SATISFACTORY.

Estimates and Particulars for every Description of Retort Extensions and other Work.

J. & H. ROBUS,

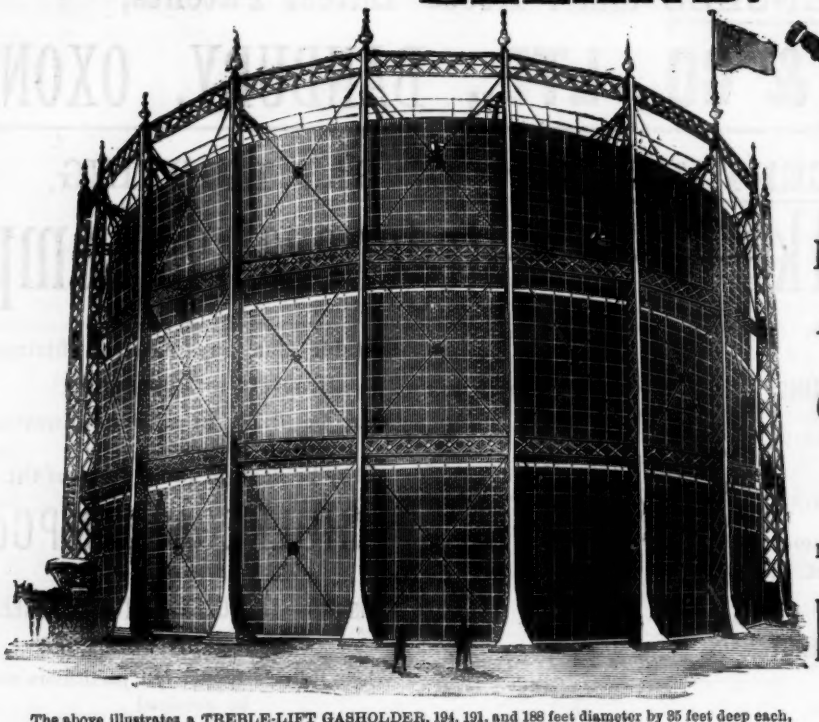
CONTRACTORS FOR GAS AND WATER WORKS,

20, BUCKLERSBURY, LONDON, E.C.

R. DEMPSTER & SONS, Ltd.,

ROSE MOUNT GAS ENGINEERING WORKS,

ESTABLISHED — ELLAND. — 1855.



The above illustrates a TREBLE-LIFT GASHOLDER, 194, 191, and 188 feet diameter by 85 feet deep each, as made for the MELBOURNE GAS COMPANY.

GAS AND CHEMICAL PLANT OF EVERY DESCRIPTION — ALL SUNDRIES SUPPLIED.

OUR

ROTARY EXHAUSTERS

Are acknowledged to excel in efficiency and finish.

OUR IMPROVED

COKE-BREAKING MACHINE

Is a pronounced success.

See Last Week's Issue.

Designs, Specifications, and Estimates submitted on application to

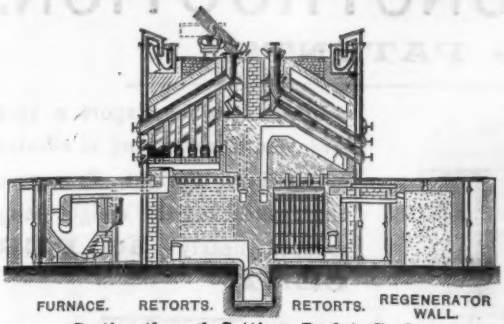
R. Dempster & Sons, Ltd.,

ELLAND.

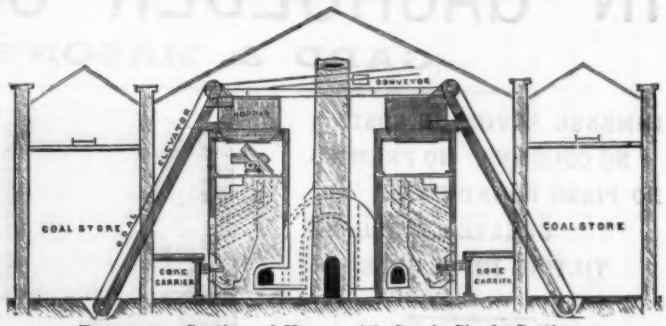
AUTOMATIC SYSTEM OF CHARGING & DRAWING INCLINED GAS-RETORTS.

Gold Medal, Paris Exhibition, 1889.

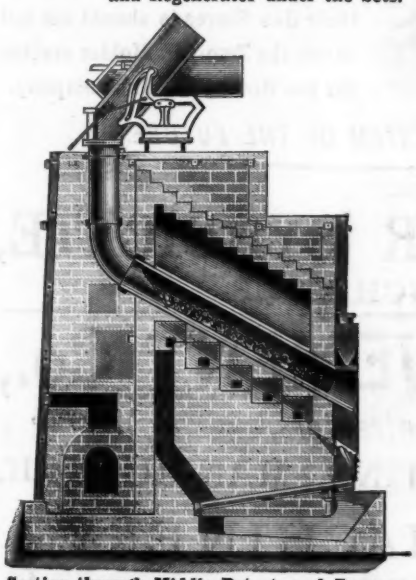
This System of Automatically Charging and Discharging Retorts without machinery or arduous labour is in operation at several places on the Continent and in America, and will shortly be at work in various Gas-Works in England.



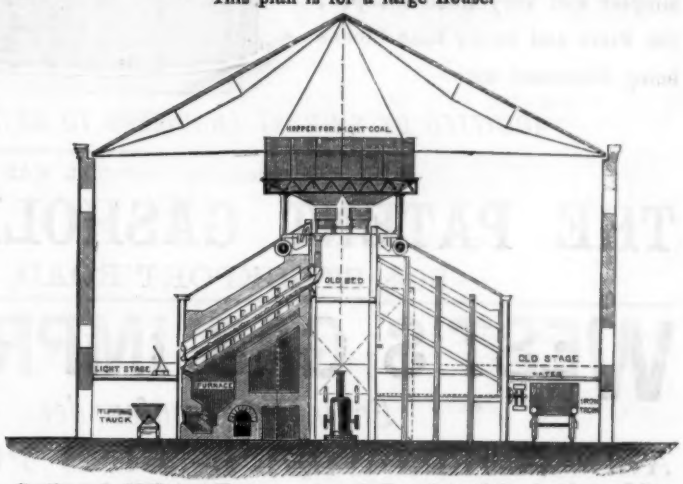
Section through Settings Back to Back. Working off ground floor with Generator under Stage and Regenerator under the Sets.



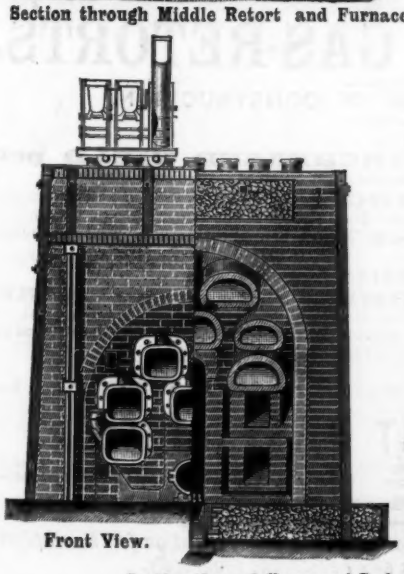
Transverse Section of House with Coze's Single Settings, Showing Method of working Two Single Settings and Distributing the Coal to the Supply Hoppers; the whole of the work being Automatic. This plan is for a large House.



Section through Middle Retort and Furnace.

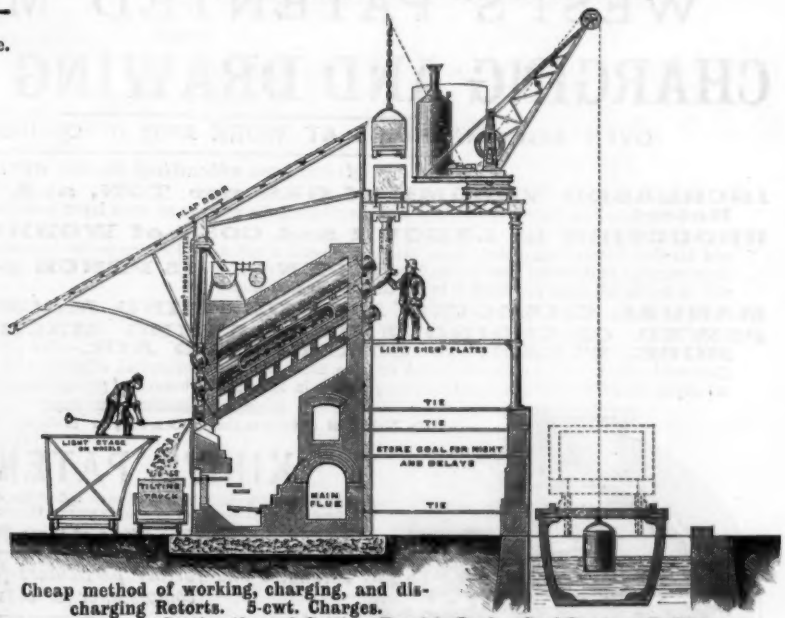


Section of old Retort-House converted, Two Sets 20 fts. in place of One. Modified form, with ordinary Retorts and Fittings.



Front View.

Section through Furnace & Bed.



Cheap method of working, charging, and discharging Retorts. 5-cwt. Charges. Section through Setting, Front to Back. Coal Barge or Railway. Light Corrugated Roof over Sets and at Sides.

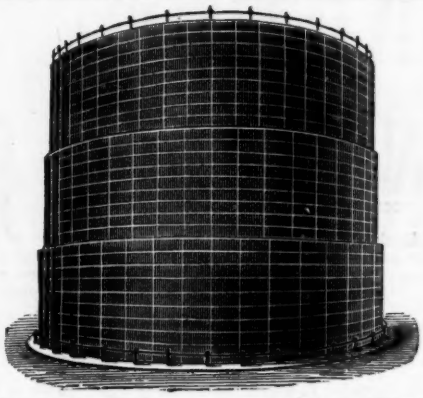
These Systems are fully Patented, and any Infringer will be strictly proceeded against.

For further particulars apply to W. M. KIGHT, Secretary of THE COZE SYNDICATE, LIMITED, 88A, LEADENHALL STREET, LONDON, E.C

REVOLUTION
IN GASHOLDER CONSTRUCTION.
(GADD & MASON'S PATENTS.)

IMMENSE SAVING IN COST.
NO COLUMNS. NO FRAMING.
NO PIERS ROUND TANK.
GREATER STABILITY.
TILTING IMPOSSIBLE.

Tank Construction rendered simpler and very much cheaper; the Piers and heavy Base Stones being dispensed with.



In Holders for Export a very large additional saving is effected in Carriage, Freight, Transport, and Insurance; the Weight being reduced nearly 50 PER CENT.

Engineers intending to extend their Gas Storeage should not fail to see the Two-Lift Holder erected for the Northwich Gas Company.

ADMITTED BY EMINENT ENGINEERS TO BE THE SYSTEM OF THE FUTURE.

Telegrams: "SPIRAL MANCHESTER."

THE PATENT GASHOLDER SYNDICATE,
504, STOCKPORT ROAD, MANCHESTER.

WEST'S GAS IMPROVEMENT Co., Ltd.,
Engineers, Ironfounders, & Contractors,
ALBION IRON-WORKS, MILES PLATTING, MANCHESTER,
MANUFACTURERS OF
WEST'S PATENTED MACHINERY
FOR
CHARGING AND DRAWING GAS-RETORTS.

OVER **160** MACHINES AT WORK AND IN COURSE OF CONSTRUCTION.

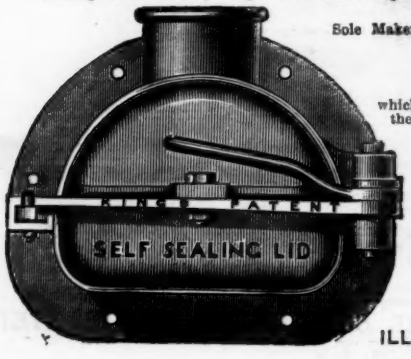
Advantages attending its use are:—

INCREASED VOLUME of GAS per TON, and INCREASED YIELD per Retort.—The system of breaking and distributing the coals in an even layer in the retorts effecting more perfect carbonization.

REDUCTION in LABOUR and COST of WORKING.—In Works where this System of charging and drawing Retorts is adopted, there has been effected a substantial saving in the cost of Gas Manufacture in the Retort-House; the amount saved varying in different Gas-Works from **8 PENCE** to **15 PENCE per Ton** of coal carbonized. Full particulars will be forwarded upon application to W. G. I. Company, Limited.

MANUAL CHARGING AND DRAWING MACHINES.

POWER CHARGING AND DRAWING MACHINES, driven by WIRE ROPE, STEAM, or COMPRESSED AIR.—The power machines are applicable to circular, oval, or Ω-shaped retorts and mouthpieces, and are the most perfect, economical, efficient, and durable machines made. They are constructed on principles founded by long and extensive experience in this special branch of gas engineering and the manufacture of gas.



Sole Makers of **Circular, Oval,** or Ω-shaped **Mouthpieces,** with Morton's Self-Sealing Lids fitted with

KING'S PATENT FASTENINGS,

which, by a simple wedging action at each end of the crossbar, secure a very tight joint; and at the same time, by their long sliding motion, they effectually remove the tar or other matter from the surfaces of the mouthpiece and lid.

N.B.—The whole of these Fittings are made of Wrought Iron.

Estimates and further particulars forwarded upon application for Mouthpieces complete, or for Lids and Fastenings separately.

Makers of THOMAS & SOMERVILLE'S COKE-BREAKING MACHINE.
Sole Makers of WHITE'S PATENT AUTOMATIC GAS-VALVE.

Mr. JOHN WEST, M. Inst. C.E., Managing Director.

ILLUSTRATED CATALOGUE SENT UPON APPLICATION.

JAMES D. PERKINS. F. SEAVERNS.

PERKINS & Co.,

228 & 229, PRODUCE EXCHANGE, NEW YORK.

Cable Address: "PERKINS, NEW YORK." *Post Office Box 3695, New York.*

SOLE AGENTS FOR THE CELEBRATED

BRECKENRIDGE CANNEL

AND THE

OLD KENTUCKY BOGHEAD

OF KENTUCKY, U.S.A.

These Cannels will rank with the Australian Shale for Gas Manufacture.

Also General Sales Agents for

PENNSYLVANIA & VIRGINIA GAS COALS, & AMERICAN FOUNDRY & FURNACE COKE.

Delivery Prices made to any Port in

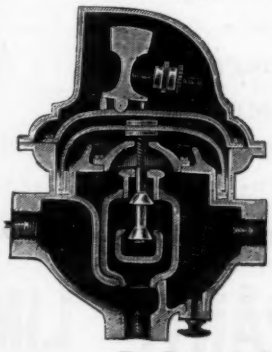
GREAT BRITAIN, ON THE CONTINENT, OR SOUTH AMERICA.

Full Information furnished upon Application to the above Address.

THE WENHAM AUTOMATIC GAS GOVERNOR

As supplied to and approved of by H.M. Government.

The most reliable Automatic Method of economizing Gas without reducing the Illuminating Power.



HUNDREDS ALREADY FIXED.

FLOOR WARMING STOVES

(LEEDS' PATENT).

CAN BE SUPPLIED FOR EITHER GAS OR OIL.

THESE STOVES ARE

CLEANLY, PORTABLE, ECONOMICAL,

And applicable for all kinds of Rooms where a Comfortable and Wholesome Atmosphere is desired.

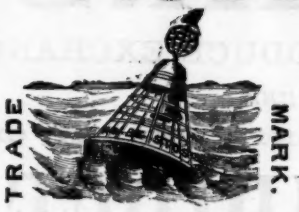
For Prices and further Particulars, apply to the Manufacturers,

THE WENHAM COMPANY, LTD.,

UPPER OGLE STREET, FITZROY SQUARE, LONDON, W.

MANCHESTER: 5, Deansgate. BIRMINGHAM: 121, Corporation Street.

BELL'S ASBESTOS AQUOL PAINT



BELL'S ASBESTOS

IS MADE READY FOR USE.

IS FIRE RESISTING.
IS WASHABLE.
IS NON-POISONOUS.
IS MANUFACTURED IN ALL USEFUL COLOURS.
IS IMPERVIOUS TO HEAT, COLD, OR WATER.
IS WITHOUT SMELL.

No expensive Oil or Turpentine required.

WILL NEVER BLISTER.

HAS A COVERING CAPACITY **40** PER CENT. GREATER THAN LEAD PAINTS.

For Outside or Inside Work in any Climate.

Bell's Asbestos Aquol Paint is equally suitable for the finest decorative work as well as for general painting. It can be applied over or under any other paint, and, owing to its easy application, can be used with a large distemper brush; the SAVING THUS EFFECTED IN LABOUR BEING **50** PER CENT. OVER THAT OF LEAD PAINTS.

Bell's Asbestos Aquol Paint is susceptible of the most delicate treatment; and, owing to its perfect flatted surface, it brings up the varnish in a manner that no other paint can equal. ONE COAT OF VARNISH ON **Bell's Asbestos Aquol** IS EQUAL TO TWO COATS ON ORDINARY PAINT.

BELL'S ASBESTOS AQUOL PAINT is specially adapted for Private Houses, Exhibition Buildings, Ships, Churches, Asylums, School Boards, Railway Stations, and all work of Wood, Iron, Cement, Plaster, Stone, Brick, &c., &c.

Those who Study Economy and Protection from Fire should use only

BELL'S ASBESTOS AQUOL PAINT.

BELL'S ASBESTOS AQUOL PRIMING is made Ready for Use.
BELL'S ASBESTOS AQUOL PRIMING stops all suction of Wood, Cement, Plaster, &c.
BELL'S ASBESTOS AQUOL PRIMING should be applied to all New Work.

Suitable for Ceilings, Walls, and New Wood, and is very durable.

BELL'S ASBESTOS AQUOL KNOTTING, for Stopping Knots in New Work.

AN EXCELLENT CURE FOR DAMP WALLS.

Colour Cards and Price Lists on Application.

Supplied in Casks of 5 to 7 cwt., and Iron Drums of 28, 56, and 112 lbs., Sample Tins of 7 and 14 lbs.

Owing to its Covering Capacity, a SAVING IN FREIGHT of 40 per cent. is effected for a given surface.

BELL'S ASBESTOS COMPANY, LIMITED,

SOUTHWARK, LONDON, S.E.

DEPOTS—MANCHESTER: Cable Street, Blackfriars. LIVERPOOL: 2, Strand Street, James Street. HULL: Humber Dock Basin. GLASGOW: 35, Robertson Street. DUBLIN: 2, St. Andrew Street. AMSTERDAM: 264, N. Z. Voorburgwal. BERLIN, BARCELONA, and ANTWERP.
AGENTS—BIRMINGHAM: BELL and Co., 7, John Bright Street. CARDIFF: BELL and Co., West Bute Street.

BELL'S ASBESTOS DAGGER PACKING

PATENT No. 15,493.

ROUND

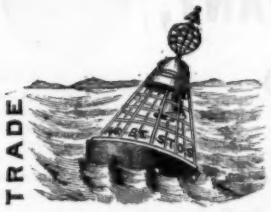
SQUARE. Every 10 feet has Label as above, and bears our Trade Mark.

Under this registered title are included the inventions of Mr. Field; and experience has proved them to be the MOST EFFICIENT DURABLE, and ECONOMICAL PACKINGS ever made. They constitute such a combination of Asbestos and India-rubber as secures the maximum of elasticity and heat resistance; and they are, therefore, UNEQUALLED FOR EVERY KIND OF ENGINE. These Packings are being universally used by most of the leading Steamship Companies throughout the world for ordinary Compound, Triple, and Quadruple Expansion Engines of the latest types. The packings are composed of rolled Asbestos Cloth, but the India-rubber is placed in two forms to suit various cases.

IN ORDERING STATE WHETHER SQUARE OR ROUND IS REQUIRED.

BELL'S ASBESTOS CO., Ld.

DEPÔTS.
MANCHESTER: Cable St., Blackfriars.
LIVERPOOL: 2, Strand St., James St.
HULL: Humber Dock Basin.
GLASGOW: 35, Robertson Street.
DUBLIN, BERLIN.



DEPÔTS.
AMSTERDAM: 264 N. Z. Voorburgwal, BARCELONA, and ANTWERP.

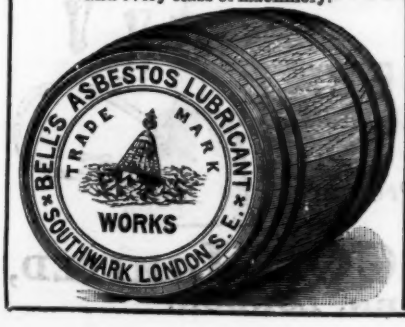
AGENTS.
BIRMINGHAM: BELL and Co., 7, John Bright Street.
CARDIFF: BELL and Co., West Bute St.

SOUTHWARK, BELL'S ASBESTOS. LONDON, S.E.

BELL'S ASBESTOS
YARN AND SOAPSTONE PACKING
Is the BEST LOCOMOTIVE PACKING made.

BELL'S
COMPOUND HYDRAULIC PACKING
Is specially suited for Hydraulic Machinery, Accumulators and Ammonia and all Pumps.

BELL'S ASBESTOS LUBRICANT
Is unequalled
For Steam-Engines & Cylinders, Gas-Engines, and every class of machinery.



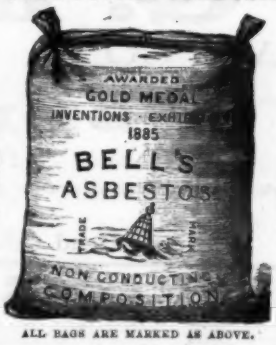
BELL'S ASBESTOLINE
The reputation of this Lubricant is based on the experience of thousands of users, which places it far in advance of those who rely only on mere laboratory tests.

ASBESTOLINE IN THE CHEAPEST MOST EFFICIENT, CLEANEST MOST INODOROUS AND SAFEST LUBRICANT.

ASBESTOLINE HAS SAVED 90 PER CENT. OVER OIL. Has been used for all purposes, AND BEATEN ALL OTHER LUBRICANTS IN ACTUAL WORK.

BELL'S ASBESTOS
EXPANSION SHEETING
RINGS, AND TAPE.
Is the most efficient and reliable Material for Manhole, Mudhole, Steam-Pipe, and all other Joints.

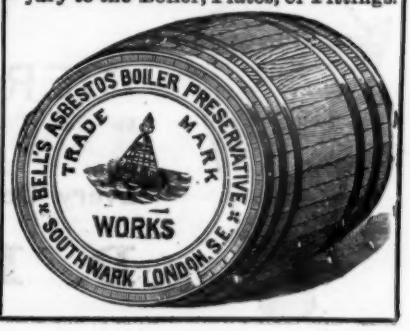
BELL'S ASBESTOS
NON-CONDUCTING COMPOSITION.
Will reduce loss by radiation and saves 40 per cent. of fuel.
Is superior to any other, and saves its cost in a few months.



Can be applied again after many years' service. Is sent out dry in bags: therefore cheaper than others sent out wet.

ALL BAGS ARE MARKED AS ABOVE.

BELL'S ASBESTOS
BOILER PRESERVATIVE
Will effectually keep Boilers clean, and remove any Incrustation, without injury to the Boiler, Plates, or Fittings.



"THE METEOR."

NEW HIGH-POWER GAS-LAMP.

Westphal's Patent.

Gas Companies should hire these Lamps to their Consumers, and introduce them for Street Lighting as a rival to the Electric Light, as they do not get out of order, are most economical, and the Burner being a circular slit does not choke up.

Particulars and Prices Free.

HENRY GREENE & SONS,

SOLE CONSIGNEES FOR GREAT BRITAIN & COLONIES,
153 TO 155, CANNON STREET,
LONDON BRIDGE, E.C.

GAS AND WATER PIPES

AND

CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY,

CHESTERFIELD.

TRADE	TELEGRAMS:	LONDON AGENTS:
C X C	"JACKSON"	BECK & Co.
MARK.	CLAY CROSS.	53, QUEEN VICTORIA ST., E.C.

HENRY BALFOUR & CO.,

LEVEN, FIFE,

MAKERS OF

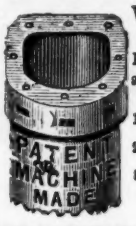
GASHOLDERS

And all classes of GAS PLANT,

REVOLVING BRUSH SCRUBBERS, FOUR-WAY VALVES.

LONDON: 13, BILLITER STREET, E.C.

WILLIAM INGHAM & SONS,



WORTLEY FIRE-CLAY WORKS,
Near LEEDS

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing Adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

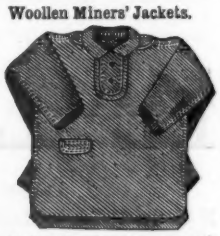
PATENT

MACHINE-MADE GAS-RETORTS.

Gas-Bags for Mains.

High-Water Boots.

Woollen Miners' Jackets.



Delivery and Suction Hose, Gutta-Percha Acid Bottles, Leather Driving Bands, Woven Canvas Hose for Fire-Engines, Wedge and Square Gas-Bags, Air and Water Beds for Invalids, Oil Tarpaulin Coats, Trousers, Hats, &c., Squeegees for cleansing Pavements, &c., Billiard and Bagatelle Cush, Tricycle Tyres, Leather Hose, Cotton Waste, Engine Cloths, Oils, &c., India-rubber Waterproof Garments for Walking, Driving, or Sporting Wear, Diving and Wading Dresses, Printers' Blankets, Iron Wheels and Rollers covered with India-rubber, and Stokers' Gloves.

Write for Price List to

THOMAS BUGDEN, Manufacturer,
116 & 118, GOSWELL ROAD, LONDON, E.C.

G. J. EVESON,

GAS COAL AND CANNEL CONTRACTOR.

PATENTEE OF

A SPECIAL COMPOUND

FOR THE CURE OF STOPPED ASCENSION-PIPES,

A couple of charges of which will clear a stopped pipe, and an occasional charge keeps them clean, and also increases the make per ton and the illuminating power.

PRICE AND PARTICULARS ON APPLICATION.

Head Office: CORPORATION STREET, BIRMINGHAM.

STREET-LAMPS,

ORDINARY OR

OUR SPECIAL HIGH-POWER.

The best Lamps in the Trade.

Street-Lamp Governors. Gas-Meters.

HULETT'S

SERVICE CLEANSER.

No Gas Company should be without this Apparatus.

THOUSANDS IN USE.

Every Description of Gas-Fittings, Pressure-Gauges, &c.

D. HULETT & CO., LIMITED,

55 & 56, HIGH HOLBORN, LONDON.

F. & C. OSLER,

(Established 1807)

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS,

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES,

TABLE GLASS OF ALL KINDS,

CHANDELIERS IN BRONZE AND ORMOLU.

MODERATOR LAMPS.

100, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

J. & W. HORTON

ETNA WORKS,

SMETHWICK,

NEAR BIRMINGHAM

(Established 50 Years),

PATENTEES

AND

MANUFACTURERS

OF

IMPROVED GASHOLDERS AND BOILERS

and Manufacturers of every description of

Gas Apparatus

Cast and Wrought Iron Tanks, Purifiers, Condensers, Scrubbers, Retort-Lids, Cross-Bars and Screws, Wrought-Iron Boilers for Stationary, Portable, and Marine Engines, Sugar Pans, Coolers, Clarifiers, Punts, Boats, Bridges, Girders, Roofs, Cisterns, Oil-Tanks, Melting-Pots, Crucibles, Salt-Pans, Arch and Range Boilers, and every description of General Ironwork.

Drawings, Specifications, and Estimates supplied.

JOHN HALL & CO.,

STOURBRIDGE,

MANUFACTURERS OF FIRE-BRICKS, LUMPS, TILES,

AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

RETORTS CAREFULLY PACKED FOR SHIPMENT.

A STOCK OF DIFFERENT SHAPES ON HAND.

JOHN ABBOT & CO., Limited.

ESTABLISHED 100 YEARS.

THE LARGEST

SULPHATE PLANT MANUFACTURERS

IN THE TRADE.

The present Low Prices render it absolutely necessary for Gas Engineers to use the commonest Pyrites Acid, and obtain the whitest and best quality of Sulphate, so as to obtain a better price and more ready market.

For this purpose they strongly recommend the

NEW IMPROVEMENTS

Combined with their

PATENT SAFETY CLOSED SATURATORS

AND

Improved Self-acting Steam Liming Process

Under pressure, effecting a considerable Saving in Time in Working off the Contents of each Still.

— OVER —

30

IN OPERATION.

A number of Plants on the Open System recently remodelled with greatly improved results.

GAS AND WATER PIPES, HYDRAULIC CRANES, CAPSTANS, BOILERS, ROOFS, TANKS, &c.

Messrs. ABBOT & Co. (Works at Gateshead-on-Tyne) employ 2000 men, including several experienced Plumbers, to erect New and remodel Old Sulphate Plants.

Applications to be made to the

LONDON OFFICE,

SUFFOLK HOUSE, CANNON STREET, E.C.

THE WIGAN COAL & IRON CO., LIMTD.,

Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.

Midland District Office: 22, TEMPLE ST., BIRMINGHAM—Sole Agent: A. C. SCRIVENER.

Telegraphic Address: "WIGAN BIRMINGHAM." Telephone No. 200.

London District Office: 6, STRAND, LONDON—C. PARKER & SON, Sole Agents.

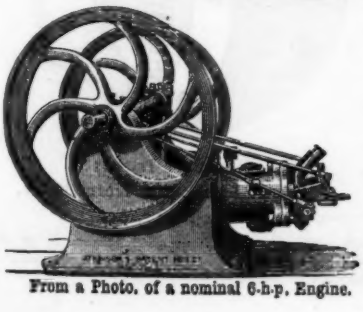
Telegraphic Address: "PARKER LONDON."

MANLOVE, ALLIOTT, & Co., Ltd.,

ENGINEERS,

NOTTINGHAM,

LONDON, MANCHESTER, AND GLASGOW.



From a Photo. of a nominal 6-h.p. Engine.

ATKINSON'S "CYCLE" PATENT

GAS-ENGINE.

The simplest and most economical Gas-Engine made.

THE BEST ENGINE FOR ELECTRIC LIGHT.

Consumes less Gas per brake horse power than any other Gas-Engine.

Telegraphic Address: "MANLOVES NOTTINGHAM."

SPECIAL NOTICE.

G. J. PARKINSON & Co.,

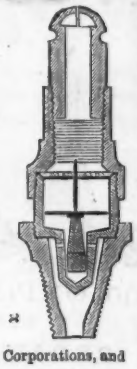
PENN STREET, CURZON STREET, BIRMINGHAM,

Have, from the 1st of January, 1890, commenced the supply of their

IMPROVED PATENT GAS GOVERNOR BURNER,

which cannot be surpassed by any other Burner in the market at the present time.

DO NOT MELT.



Please mention when required for Cannel Gas.

PRICE **14s.** PER DOZEN. *Trade Terms and further particulars on application.*

They will be pleased to supply a sample of their IMPROVED PATENT STREET LAMP GOVERNOR, *free of charge*, to Gas Companies, Corporations, and Municipal Authorities on application.

RUSCOE'S PATENT MACHINE

FOR DRILLING AND TAPPING WATER-MAINS AND GAS-MAINS UNDER PRESSURE.

Patent Saddle Back and Drilling Apparatus, whereby Gas and Water Mains can have 2-in., 3-in., 4-in., 5-in., and 6-in. Branches put on without loss of Water or Gas.

Sole Maker of HELPS' PATENT PIPE EXTRACTOR.

Prices and Particulars on Application to

JOHN RUSCOE, Albion Works, Hyde, near Manchester.

FIRE BRICKS,

LUMPS, TILES,

BLOCKS, &c.

Special Bricks for Intense Heats.

GAS RETORTS.

CASTINGS AND EVERY REQUISITE FOR GAS-WORKS.

MOBBERLEY & PERRY,

Fire-Brick Works, STOURBRIDGE.

☛ **Retort Setters sent to any part of the Kingdom.**

Laycock and Clapham's Patent.

The most efficient Machine known for extracting Ammonia and other Impurities from Coal Gas.

MACHINES with a total capacity of **42,500,000** cubic feet now working, and give great satisfaction.

LAST YEAR 11 Machines erected with a total capacity of **20,000,000** *feet.*

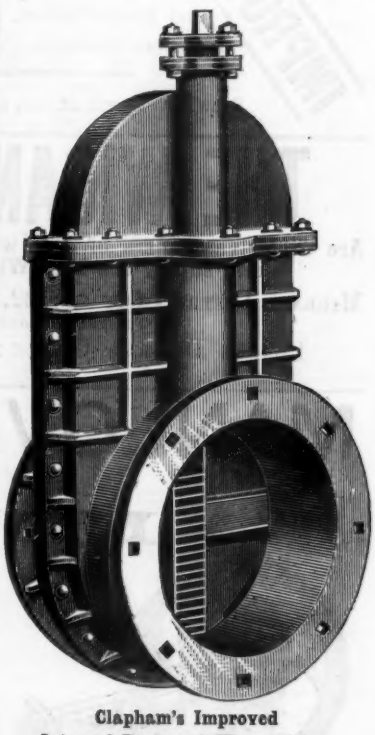
Send for Descriptive Catalogue to the Sole Makers:

Clapham Bros., Wellington, Nelson, & Market St. Works,

KEIGHLEY, YORKS.

Agents:—Mr. W. F. Roe, 52, Queen Victoria Street, E.C.
Mr. Maurice Schwab, 96, Deansgate, Manchester.
Mr. E. H. Wardwell, 10, Warren Street, New York, U.S.

SILVER MEDAL, Inventions Exhibition, 1885.



Clapham's Improved Internal Rack and Worm Valve, Gas-Mains, &c.

London: Printed by WALTER KING (at the Office of King, Sell, and Railton, Ltd., 12, Gough Square); and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, July 8, 1890.